RAILROAD GAZETTE

FRIDAY, AUGUST 14, 1903.

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Contributions

Technical Education of Apprentices.

Britannia Iron Works,
Derby, England, July 23, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In every country this is becoming a very interesting and most important subject. It may be interesting to you to know that as far as this country is concerned, I have started a new system in regard to encouraging our apprentices to take up technical classes. The following is briefly the scheme which has been adopted at these works in Derby: We have arranged to pay half the fees, and purchase the necessary instruments and books for all our apprentices who take advantage of the evening classes at the local technical college in approved subjects, for a term of three years.

Every apprentice passing the examination at the end of each year will receive increased wages per week, and those apprentices who pass all the examinations will be allowed to retain the instruments purchased for them. I should be grateful to your subscribers if they would kindly give me any information in regard to what is being done in the United States in regard to this subject, especially on the following points, viz.:

(a) The system pertaining to apprentices in engineering works both private and government.

(b) What effort is made by employers in these two classes to promote the technical education of their apprentices, their attitude, the course followed, and the results obtained.

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Nickel Steel: Its Properties and Applications.*

BY ALBERT LADD COLBY.

In 1899 in discussing the well-known paper of Mr. James Riley, the father of nickel steel, Mr. Snelus remarked that Shakespeare told them that they might find "tongues in trees, sermons in stones, books in running brooks, and good in everything," and those who had studied meteorites appeared to have overlooked the fact that the metallic meteorites consist largely of alloys of iron and nickel, the practical applications of which they were now for the first time becoming acquainted with, in alloys of iron and nickel produced by themselves. "He was ashamed that he, himself, had so long overlooked Nature's teachings."

While my search through the Proceedings of Scientific Societies for the past 80 years shows that Mr. Snelus was a little severe in his criticism of his fellow iron-masters, inasmuch as the advantages of alloying nickel with iron and steel have been known and acknowledged by many investigators over a long period of years, it is nevertheless true that Mr. Riley was the first to publish a series of practical experiments proving the valuable properties possessed by nickel steel, and pointing out many of its important applications.

In 1822 Stodart and Faraday published their experiments made at Sheffield in the alloying of nickel and iron. A little later Berthier made some similar experiments in France.

In 1830, Wolf, of Scheinfurt, Germany, put some nickel-iron alloys on the market, which he called "Meteoric Steels." They were damasked, and Liebig comments on their magnificent appearance in a note in the *Annalen der Pharmacie*, and states that this alloy is destined to be developed in the near future.

In 1853, Fairbairn published some experiments undertaken to determine the strength of some alloys of nickel and iron similar in composition to meteoric iron.

At the exposition held in New York, in 1853, Philip Thurber exhibited several samples of nickel steels produced from a nickeliferous limonite.

In 1858, Sir Henry Bessemer made an experimental 3 per cent. nickel-iron alloy, with a view of making what he termed "Meteoric Iron Guns." He did not, however, pursue the subject, nor publicly refer to the matter until 1896.

Percy, in his Metallurgy published in 1864, refers to experiments conducted by Richardson in his (Percy's) laboratory on nickel-iron alloys varying from 1.00—50.00 per cent. in nickel.

In 1870, Alex. Parkes, of Birmingham, took out several patents for the production of alloys of iron and steel.

In 1883, John Gamgee made nickel-iron alloys in Connecticut.

In 1884, A. M. Clark, of London, patented the manufacture of a malleable ferro-nickel.

In 1885, ferro-nickel was manufactured at Marbeau's Works at Montataire, France, under the supervision of Bertheault.

In 1887, highly carboniferous nickel steels were made experimentally at the steel works at Imphy, France.

In 1888 and 1889, several French and English patents for the manufacture of nickel steel, and its applications, were granted to Marbeau, Schneider, Riley and Hall.

It is therefore evident that the advantages of allowing nickel with iron and steel have been known for some time. The credit of making the first systematic series of practical tests on nickel steels belongs, however, to Mr. James Riley, then of Glasgow, whose elaborate paper on "The Alloys of Nickel and Iron" was read by him before the Iron and Steel Institute of Great Britain on May 8, 1889. From a discussion of this paper it appears that J. W. Hall, of Sheffield, had been working on similar lines to Mr. Riley, but his results had not been publicly put on record. Mr. Riley's paper gave the impetus to the introduction of nickel steel in a commercial way.

Since Riley's practical and suggestive paper, the technical men of many steel works in France, Germany, Great Britain and America, have made nickel steel, studied its physical properties and have put it on trial for a wide variety of purposes. In this work they have been aided by consumers looking for a better material, by the scientists connected with the technical universities in each country, as well as other independent investigators.

Manufacture of Nickel Steel.

No detailed reference to the melting of nickel steel and its subsequent rolling, forging and machining is possible within the scope of this paper. As is well known, nickel steel is melted in both the acid and basic open hearth furnace, in the Bessemer converter and in the crucible. From personal observation, the writer has found that the valuable properties of this special steel have been recognized and applied by the principal steel makers of Great Britain and the Continent, as well as by several of the steel melters of America. The physical constants of the metals, nickel and iron, are so closely allied, a fact proven by their occurrence in metallic meteorites, that no special precautions, other than those incident to good melting practice, are necessary during any of the above standard processes of steel melting, in order to insure a *thorough mixture* of the nickel and iron in the manufacture of nickel steel of any desired percentage of carbon, and with or without the presence of special elements, such as chromium, manganese, tungsten, molybdenum, etc. This fact is of great practical importance, especially in such applications as armor plate, marine and stationary shafting and engine forgings, rails and bridge material which necessarily involve the casting of large masses of this special steel. Precautions must be taken in the rolling or forging of nickel steels, and especially in their final heat treatment; the steels below 15.00 per cent. nickel are also more difficult to machine than simple steels of the same carbon content. These difficulties have, however, formed no serious barrier to its successful introduction for a wide variety of purposes.

Physical Properties of Nickel Steel as Compared With Carbon Steel.

When the physical properties of nickel steel, as compared with those of carbon steel, are better known and more fully appreciated, the amount now used for the purposes for which it has already been successfully introduced will be considerably augmented and new applications will undoubtedly result. It is appropriate, therefore, to review some of the more striking physical properties, obtained as suggested by Snelus, by "following Nature's teachings and alloying nickel with iron."

The modulus of elasticity or "coefficient of elasticity" of such materials as steel which have a well defined elastic limit, is determined by dividing the tensile stress in pounds per square inch at any point in the test below the elastic limit, by the elongation per inch of length produced by said stress. The modulus of elasticity which may therefore properly be regarded as the measure of the stiffness of the material is remarkably constant in steel notwithstanding great variations in chemical analysis, temper, etc. Young's modulus is practically the same for both tool steel containing 1.40 per cent. carbon and for the mildest steel used in boilers. The modulus of elasticity of steel is in fact rarely found to be below 29,000,000 or above 31,000,000, and is generally taken at 29,500,000 or 30,000,000 in engineering calculations.

A prejudice exists against nickel steel in the minds of some engineers owing to items which have appeared in the technical journals that the modulus of elasticity is lower in nickel steel than in carbon steel. The fact is, however, that while the high nickel steels, especially those containing 20.00 per cent. nickel or over, do have a lower modulus of elasticity than carbon steel, nickel steels containing say 4.00 per cent. of nickel or less, such as are applicable for shafting, forgings, bridge construction, rails, etc., have the same modulus of elasticity as carbon steels, viz., in the neighborhood of 29,000,000 lbs. per sq. in.

In proof of this assertion, the writer could quote the result of many calculations of the modulus of elasticity of various steels, containing below 5 per cent. nickel, made from the detailed records of the physical tests published annually by the U. S. Army Testing Laboratory at Watertown, Mass., under charge of Mr. J. E. Howard, the accuracy of whose work is beyond question. Evidence could also be cited from the experiments of foreign scientists such as Mercadier, Wedding, Rudeloff and Guillaume, all of whom support the above assertion that the presence of 4.00 or 5.00 per cent. of nickel in steel has no appreciable effect in reducing its modulus of elasticity.

If space would permit, a large amount of evidence could be cited to prove that nickel steel is chiefly distinguished from simple carbon steel by its proportionately high elastic limit. Furthermore, if 3.00 per cent. nickel is alloyed with an open hearth steel of 0.25 per cent. carbon, it produces a metal equal in tensile strength to a simple carbon steel of 0.45 per cent. carbon, but having the advantageous ductility of the lower carbon steel.

On low carbon steels not annealed, the addition of each 1.00 per cent. of nickel up to 5.00 per cent. causes approximately an increase of 5,000 lbs. per sq. in. in the elastic limit and 4,000 lbs. in the ultimate or tensile strength. The influence of nickel on the elastic limit and ultimate strength increases with the percentage of carbon present; high carbon nickel steels showing a greater gain than low carbon nickel steels.

In short, the addition of nickel to steel raises the proportion of elastic limit to ultimate strength and adds to the ductility of the steel. This effect of nickel in increasing the ratio of the elastic limit to tensile strength, without sacrifice in ductility, accounts for the increase in the working efficiency of nickel steel over carbon steel, in other words, its increased resistance to molecular fatigue.

The comparison of the results obtained from a large number of tests cut from full sized prolongation of forgings of both carbon steel and nickel steel, show that for a given tensile strength the presence of 3.00 to 4.00 per cent. of nickel increases the elongation and to a greater extent the contraction of area. On the other hand comparing simple carbon steel and 3.00 to 4.00 per cent. nickel steel of the same carbon content, the nickel steels will be found to have from 35 to 40 per cent. greater tensile strength with practically the same elongation and contraction of area as the simple carbon steel. This increased ratio in the nickel steel, of ductility to elastic limit and tensile strength, is another index of its increased value over carbon steel and for purposes where in service the material must resist severe and sudden shocks or rapidly repeated alternating stresses.

The exhaustive series of experiments made by Wedding and Rudeloff show that the resistance to compression of nickel-iron alloys increases steadily with the per cent. of nickel present, until 16.00 per cent. of nickel is reached. Hadfield has also made a very complete series of experiments on the resistance of nickel steel to compression. He has found that a steel containing 0.27 per cent. nickel shortened, under a compression of 100 tons (224,000 lbs.) per sq. in., 49.90 per cent. in a length of 1 in.; a steel with 3.82 per cent. nickel shortened 41.38 per cent.; with 5.81 per cent. nickel 37.76 per cent., and with 11.30 per cent. nickel only 1.05 per cent. He states that an ordinary mild carbon steel without nickel, under similar conditions would be shortened 60.00 per cent. to 65.00 per cent. He also states that the increased resistance to compression of nickel steel is not due to its hardness; an important point in the practicable application of nickel steels where machining is necessary. He argues that the toughening action of nickel when added to steel is caused by a very intimate combination of the molecular structure and that this advantage is further enhanced by the fact that the nickel does not show a disposition to segregate in steel like other elements; in other words, it appears to be more intimately combined.

A striking illustration of the ability of nickel steel to resist compression was exhibited to the writer in 1900 by Holtzer & Co. A cylinder 7.87 in. in height, 6.97 in. external diameter and walls of .73 in. in thickness cut from a nickel steel gun hoop, was compressed by a load of 886 gross tons down to a height of 4.72 in. The internal fibers were thereby extended 46 per cent., and without the formation of any cracks. The superior stiffness of nickel steel over carbon steel without any sacrifice in its toughness has been proved in numerous applications coming under the writer's observation; this combination of properties forms one of the strongest arguments in favor of the use of nickel steel for a wide variety of applications where the service demands a rigid, as well as a strong elastic and tough material. H. A. Wiggin states

*Extract from a paper read at the July meeting of the American Society for Testing Materials.

that, in his experience he found that nickel steel under the drop test gives better results than carbon steel, even in a greater ratio of superiority than exists in the comparison of the tensile tests of the two steels.

J. G. Eaton made a comparative test of nickel steel plate and carbon steel plate with a view of subjecting both plates to the same strains as those experienced by bottom plating. Both plates were riveted to angles in a manner intended to imitate the riveting of a ship's plate between the frames. A round faced punch placed on each plate was then struck by a heavy falling weight. Each plate endured 13 blows before rupture and at the next blow each plate showed a clear aperture; that in the carbon steel plate, however, was $23^{1}/_{10}$ sq. in. in the clear, while the aperture in the nickel steel plate was ¾ of a sq. in.; a ratio, therefore, of 30.5 to 1. in favor of nickel steel. D. H. Browne states that a 3 per cent. nickel steel shows about 48 per cent. greater stiffness and 45 per cent. greater toughness than carbon steel; the word "stiffness" referring to the amount of deflection produced by the blow, while the word "toughness" refers to the number of blows required to produce the rupture.

Nickel steel will resist bending both before and after quenching better than carbon steel of similar tensile strength. This has been strikingly illustrated in a long series of practical tests made on nickel steel plates by Mr. Beardmore at his Parkhead Steel Works at Glasgow, Scotland. These tests included quench bends, cold bends, and also cold bending tests of the nickel steel plates with holes drilled in the tests prior to the bending. The results of Hadfield's careful experiments on the bending properties of cast and forged nickel iron alloys, varying from 0.27 to 49.65 per cent. of nickel, may be summarized in his statement "that from about 2.50 to about 6.00 per cent. nickel the bars certainly showed greater bending angles than those of any other iron alloys experimented on," by him.

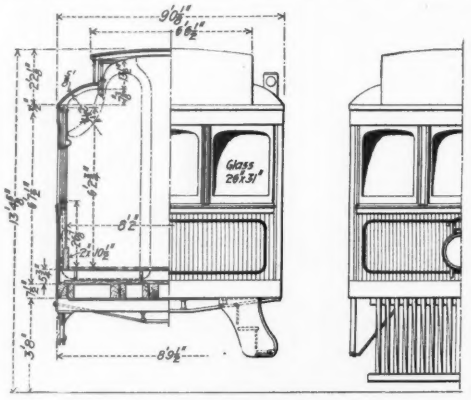
In a series of comparative tests of carbon steel and nickel steel, such as is used for forgings, made at the works of the Bethlehem Steel Company, the writer obtained bending tests on the unannealed, annealed and oil-tempered nickel and carbon steels which show the superiority and freedom from brittleness of the nickel steel. A comparison of the physical properties of the two steels is as follows:

Heat treatment given to each steel.	Lbs. per sq. in. Tensile strength.	Elastic limit.	Elongation, p.c. in 2 inches.	Contraction of area. per cent.
Annealed carbon steel....	109,500	51,440	19.50	30.31
Annealed nickel steel.....	100,330	66,720	25.00	54.50
Oil-tempered carbon steel..	129,360	67,230	17.50	38.53
Oil-tempered nickel steel...	103,890	76,390	25.00	61.56

It has been definitely proved that a very low carbon steel cannot be made hard by the mere addition of nickel. Nickel steel is tougher than carbon steel but is not harder, in the true meaning of this latter term. The hardness of nickel steels, below about 15.00 per cent. of nickel, depends upon the proportion of nickel and carbon jointly. Thus while a steel with 2.00 per cent. nickel and .90 per cent. carbon cannot be machined, a steel with 3.00 per cent. nickel and .60 per cent. carbon can be machined. The freedom from hardness of comparatively low carbon nickel steel is strikingly illustrated by the writer's experience in cutting with a pen knife the rifle barrels made, at Bethlehem, of steel containing 4.50 per cent. nickel and 0.30 per cent. carbon, and yet this steel had an elastic limit of over 80,000 lbs. and a tensile strength of over 100,000 lbs. per sq. in. At 20 per cent. of nickel, as stated by Riley, successive increments of nickel tend to make the steel softer and more ductile, and even to neutralize the influence of carbon.

Nickel steel resists torsion or twisting stress better than the same class of carbon steels. Riley's experiments indicate that it is not necessary to use steels high in nickel to obtain the best effect in torsional resistance. The writer has found that several of the French steel works have appreciated this property of nickel steel by applying it for the manufacture of special wire and springs.

The rigidity and toughness of nickel steel makes it a desirable metal where, in service, the material is subjected to wear or abrasion. Practical evidence of this statement is found in the three years comparative trial of nickel steel and carbon steel rails on the "horse-shoe" curve of the Pennsylvania Railroad, which has recently resulted in orders being placed for some 10,000 tons of nickel steel rails for the sections of the tracks of the Pennsylvania, Baltimore & Ohio, and New York Central



Cross Section and End Elevations.

& Hudson R. R., where in the past frequent renewals of the carbon steel rails have shown their inability to withstand the severe abrasion due to the sharp curves and heavy traffic.* Further evidence of the value of nickel steel to withstand abrasion is found in the results of experiments carried on by one of the French railroads in the trial of nickel steel for locomotive tires.

The coefficient of expansion of nickel steel varies greatly with the percentage of nickel present; especially in the series of nickel steels containing from 20.00 to 45.00 per cent. of nickel. The 36.00 per cent. nickel steel called in France "Invar" (from the word "Invariable") has a lower coefficient of expansion than any other metal or alloy known. Guillaume, of the International Bureau of Weights and Measures, the best authority on this subject, and whose opinion is also supported by other experts, states, however, that there is no practical difference between the expansion of simple carbon steel and of steel containing up to 5.00 per cent. of nickel. In the use, therefore, of low carbon 3.00 to 5.00 per cent. nickel steels in bridge construction the same allowance for expansion can be made as when carbon steel is used. This is an important point especially when both carbon steel and nickel steel are to be used in the same structure. The different coefficients of expansion of steels, containing from 30.00 to 45.00 per cent. of nickel have resulted in their application in France and Germany for a wide variety of purposes, which will be referred to later.

*See remarks of Messrs. John McLeod and C. B. Dudley.

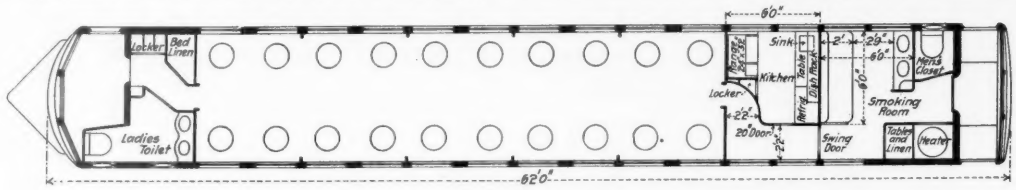
Beardmore, the Scotch steel maker, after an elaborate series of tests, places the loss of strength due to punching ordinary mild steel at 33 per cent. of the original strength, and claims that the loss of strength in punching nickel steel varies from 15.5 to 20 per cent. of the original strength, and furthermore that on thicker sections of nickel steel plate the loss of strength is only about 10 per cent. A number of other experimenters have also found that nickel steel plates are not weakened by punching to as great an extent as carbon steel plates. There is ample evidence that the presence of nickel in steel increases its shearing strength. This is important especially in connection with riveted work, as the strain on the rivet is not a simple strain but rather a shearing or cutting action. Moreover, in the shearing of nickel steel rivets, the fracture is fibrous and the metal appears to have torn gradually, whereas in ordinary carbon steel rivets, the metal breaks off short.

From the results of a comparative test made at Bethlehem on nickel steel and carbon steel rivets, the conclusion was drawn that "it may be safely deduced that a ¾ in. nickel steel rivet will replace a $1^{1}/_{16}$ in. or even possibly a 1⅛ in. common steel rivet, thus effecting a saving of considerable plate section and giving increased strength." Experiments made by Beardmore, Abraham and Rudeloff and at the Creusot Steel Works, also testify to the increased shearing strength of nickel steel rivets, and experiments made by the Société Denain and d'Anzin prove that 5.00 per cent. nickel steel rivets possess over twice the shearing strength of iron rivets. Browne states that the sheared edges of carbon steel plates often cut ragged whereas nickel steel cuts clean.

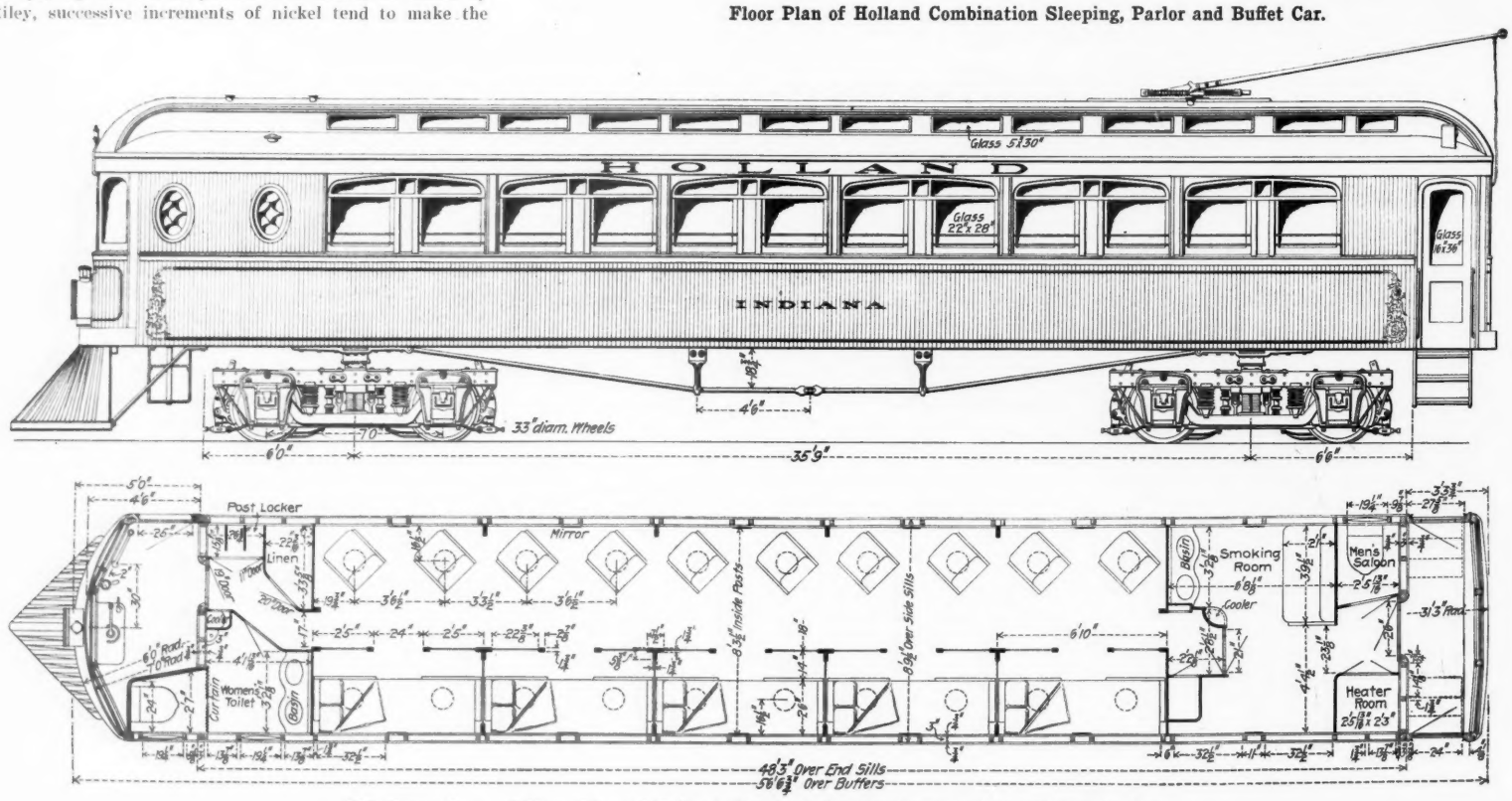
Segregation.

The writer's opinion, based upon a large number of chemical analyses made at Bethlehem, is that nickel in itself segregates but very slightly even in large armor plate and shafting ingots. This is natural as the atomic volume, atomic weight and specific gravity of nickel are similar to those of iron.

Some experimenters testify that nickel tends to check the segregation in steel of the other elements such as sulphur, phosphorus, carbon, manganese and silicon. Mr. Hadfield thinks that the tendency of nickel to check segregation is probably due to the fact that it raises the melting point of the carbides or cementing material and causes the whole mass to set more nearly together, and quotes in proof that nickel steel ingots have a finer grain than carbon steel ingots. Mr. Chase, of the Midvale Steel Company, states that "nickel is supposed to lessen the segregation and liquation of carbon by combining with the carbon which cements the particles of iron together, and thus bringing the specific gravity of the carbon compounds nearer to that of the rest of the alloys in the fluid mixture.



Floor Plan of Holland Combination Sleeping, Parlor and Buffet Car.



Side Elevation and Floor Plan of Holland Standard Combination Sleeping and Parlor Car.

It also seems to cause this cementing carbon to solidify at more nearly the same temperature as the other alloys."

Mr. Campbell, of the Pennsylvania Steel Company, made a series of tests to prove what he states to be the current impression among manufacturers of nickel steel that the presence of this element prevents segregation. His conclusion is that there seems to be good ground for the assumption that nickel prevents the separation of the metalloids, but that it does not prevent it altogether, and he states that it is not probable that any other agent will ever be found competent for this task.

Within the limits of this general review, it is impossible to refer in detail to the interesting subjects of the heat treatment, the critical points, the molecular relation of nickel to iron and carbon and the microstructure of nickel steels; the effect of extreme temperatures and the electrical and magnetic properties particularly of steels containing over 20.00 per cent. of nickel. Sufficient evidence has, however, probably been presented to prove that nickel steel possesses many advantages of practical importance over simple carbon steels, and the engineer looking for a trustworthy material will be convinced by what has been presented, that it is safe to give nickel steel a practical trial.

Sleeping Cars for Electric Roads.

The Holland Palace Car Company, of Indianapolis, Ind., is having built at the works of the Harlan & Hollingsworth Company at Wilmington, Del., two sleeping cars of an original design, which will be operated over the lines of the Indianapolis & Eastern (electric), and the Applevard Syndicate lines from Indianapolis to Columbus, Ohio. These cars are to be completed and in operation by the 15th of September, and will mark another step in the rapid advancement of electric railroads.

The car was designed by Mr. H. F. Holland, President of the Holland Palace Car Company, and differs from the Pullman type of sleeping car in its berth arrangements.

Fig. 2.—Type of Chair to be Used.

The side elevation and floor plan are shown in the accompanying engravings. Each car will be operated individually and is mounted upon two four-wheel trucks which carry a 150 h.p. motor on each axle. At the front of the car is the motorman's compartment. Next to this is the ladies' toilet room and two lockers. The main room of the car is 34 ft. 2 in. long, and divided into 10 compartments at night, each 6 ft. 10 in. long and containing an upper and lower berth. The smoking room and men's toilet is between the main compartment of the car and the vestibule platform, which differs very slightly from that used on steam road cars. The body of the car is 48 ft. 3 in. long and 8 ft. 9½ in. over sills. The height from rail to top of car is 13 ft. 4⅝ in., and the clear head room inside, from floor to deck line, 6 ft. 5¾ in. The framing is not shown in detail in the drawing, but differs very slightly from that used in other types of heavy interurban cars. No attempt is made to carry much of the load on the truss framing in the sides of the car, dependence being placed on heavy underframing supported with truss rods. There are six sills, 7 in. x 7 in., made of two pieces, with a half-inch steel plate sandwiched in between. The exterior of the car has very much the appearance of a standard railroad coach, with deck lights and broad double windows, extended vestibules and oval windows in the lavatory.

The most interesting feature of these cars is the arrangement for making up the berths at night. The car is intended to render a double service, being used in the daytime as a parlor car, and at night as a sleeping car. On the floor plan is shown one-half of the car with the chairs arranged for day travel, and the other half of the car with the compartments up and the berths made ready for night travel. There are 10 chairs on each side, mounted on revolving pedestals, 16½ in. from the side of the car. These chairs are spaced 3 ft. 6½ in. and 3 ft. 3½ in. apart, the narrow spacing being between the chairs which are turned back to back when the berths are made up. The general appearance of the car for day travel is shown in Fig. 1, which is a section of the car built for exhibition purposes. The two chairs shown in this photograph are the first type of chair adopted, but in the cars now building these will be replaced by a handsomer and more comfortable chair shown in Fig. 2. To make up the berths at night, the catch shown in the lower part of the side panel of the chair is released and the back pulled out about 6 in. The arm next to the wall is dropped down to a horizontal position, filling the space between the chair and the side of the car. The seat cushion is pulled forward and laid on top of two supporting rods which fit into the sockets shown in the front panel of the chair. The outside arm of the chair is then removed completely and used to fill the space between the two chairs and the wall. To complete the making up of the lower berth, the back cushion of the chair is pulled down to form the end of the bed, and the head roll on the seat dropped forward to form a pocket for clothes. All of the mattresses, pillows, bed clothing, etc., are carried in the pocket formed by the upper berth front and the deck. This part of the car is exactly similar to that used on Pullman cars, except that the berth pocket is narrower, since both berths are intended for a single occupant only. In Fig. 3 is shown the berth made ready for the night. It will be seen that both the upper and lower berths are completely screened off by the solid compartment which is built up around each section. This feature of the car is one of the most ingenious of its entire construction. In the floor plan is shown the general location of the removable posts in which the flexible wooden screens slide. In Fig. 3 it will be noticed that there is an ornamental open grille which extends down from the roof of the car to a point on a level with the eaves. This grille forms the top support for the posts. By day the posts are carried in a locker shown in the floor plan at the front end of the car next to the motorman's cab. After the beds have been made up, the posts are inserted in suitable sockets in the floor and secured by catches to the bottom edge of the grille. The partitions, which are of mahogany, are made on the principle of a roll-top desk and, when not in use, are stored under the false floor of the car as shown in the cross-section. The false floor of the car is raised 5 in. above the true floor, and in the space thus formed are guides in which the partitions run. The grooves in the floor through which the curtains are pulled out are covered by day with brass cover plates. The partitions which form the two panels next the aisle slide under the floor and up into a pocket in the side of the car between the outside sheathing and the inside panels. The partitions which are formed between each compartment are carried entirely under the floor. These are finished in handsome tapestry as shown in the photograph. When the compartments are ready for occupancy, there is a space 14 in. wide by approximately 6 ft. 9 in. long, in which the passenger has complete privacy, and which gives ample room to comfortably remove and put on clothing. The opening between the two aisle panels is closed by a heavy curtain, not shown on any of the photographs, which allows for some ventilation. Further ventilation is provided by having openings about 4 in. high at the bottoms of the partitions so that a continued circulation of air is kept up, rising from the bottom of the compartment and passing out through the open grille work at the top and thus out through the deck ventilators.

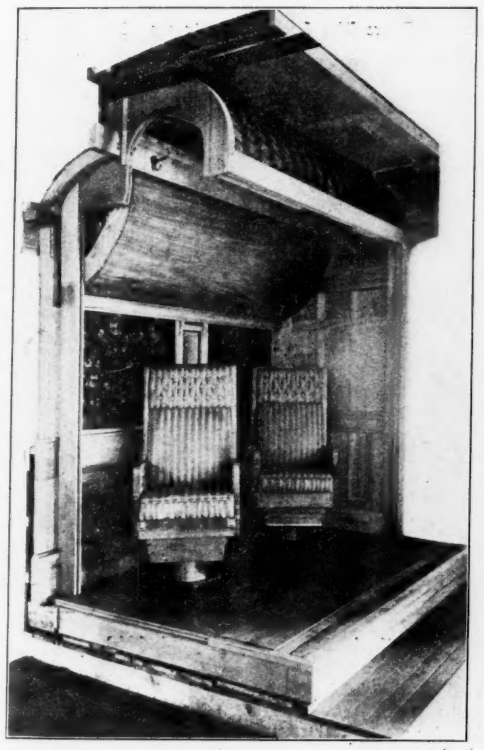


Fig. 1.—Section Made Ready for Day Travel.

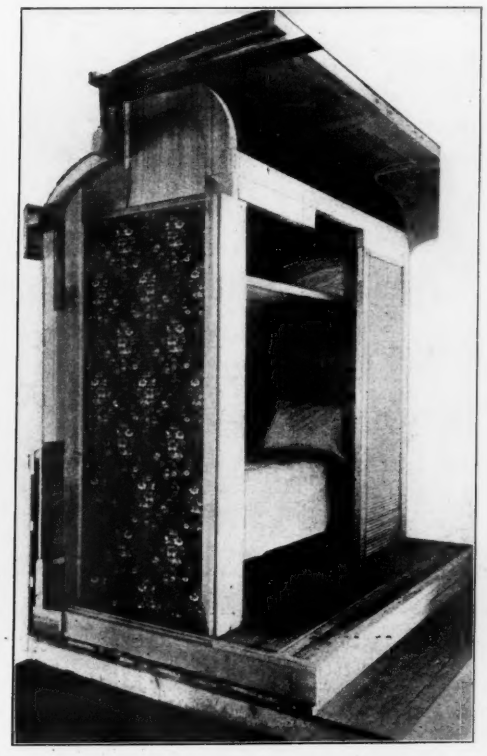


Fig. 3.—Section Made Up With Upper and Lower Berth.

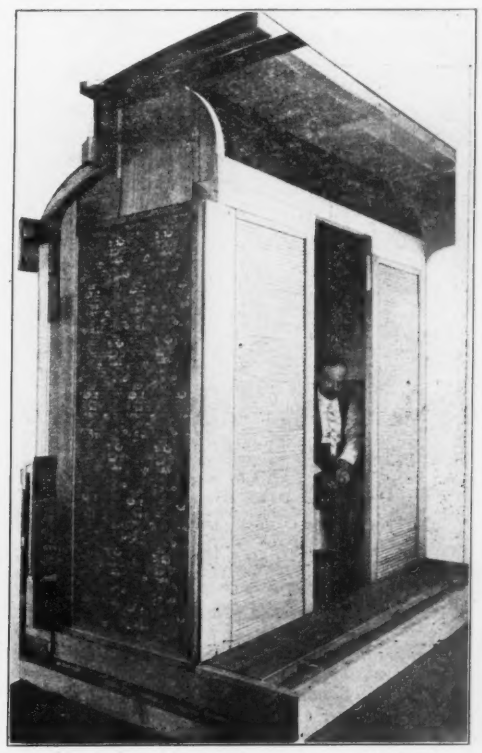


Fig. 4.—Showing Space Between the Partitions and the Berth.

The accommodations in the toilet rooms for both men and women are quite as complete and commodious as those found on any steam road sleeping car, and every provision has been made for the comfort of the passengers. The cars will be heated by electricity, but a system of hot water heat has been installed to provide against emergencies. The interior finish of the car will be in handsome inlaid mahogany. Between each pair of windows is a heavy beveled glass mirror and decorated art glass is to be used in the oval windows and in the top sash of each of the double windows. Special attention has been paid to the elimination of noise and vibration, and the space between the deafening floor and the true floor of the car has been packed with mineral wool to deaden noise and jar.

The floor plan of a similar type of car is also shown which has, besides the accommodations of the cars now being built, a kitchen and complete outfit for serving meals. This car is 62 ft. long on the bumpers, but is in every other way similar to the Indianapolis & Eastern cars.

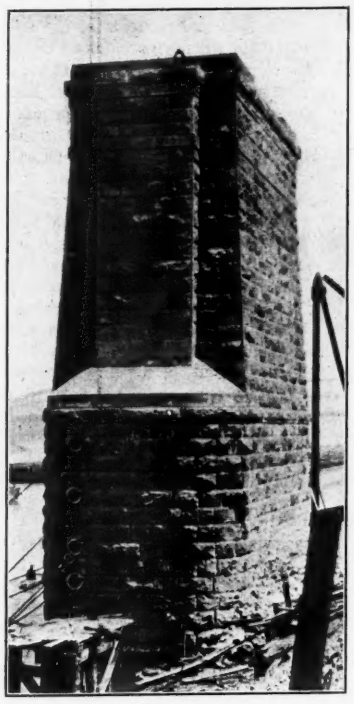
The Holland Palace Car Co. will operate these cars on the same general plan as the Pullman Co., collecting the seat and berth fares and charging the electric road with mileage at a rate to be agreed upon by the sleeping car company and the railroad. The rate of fare for berths between Indianapolis and Columbus will be $2.00 for the lower or upper berth, but when the entire compartment is taken by one person the rate will be $3.00. The chair car fare between the same points will be $1.00 per chair. These rates are practically the same as the Pullman rates on the steam road, the saving to the passenger being the difference in the railroad fare, a round trip over the electric road for the same price as a single trip ticket over the steam road. The cars will make one round trip every 24 hours, going one way as a sleeping car and returning as a chair car.

The Wabash Bridge at Pittsburg.

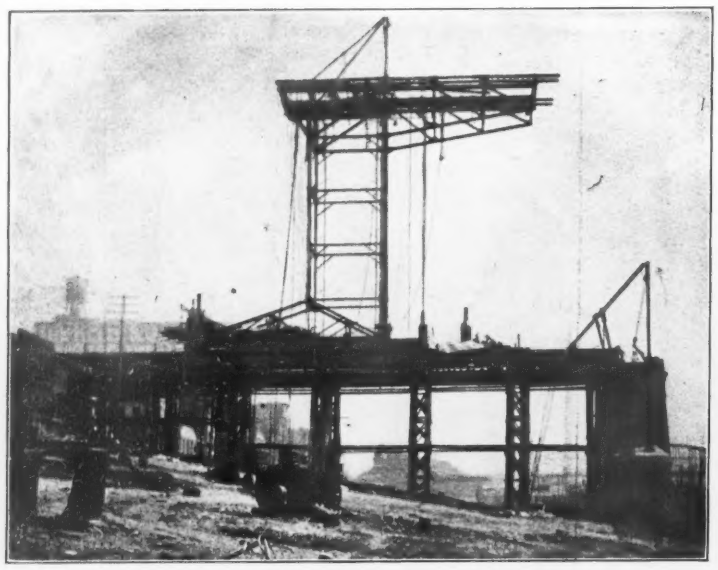
Work on the Pittsburg, Carnegie & Western double-track cantilever bridge over the Monongahela River at Pittsburg, which was described in the *Railroad Gazette* March 14, 1902, has progressed rapidly during the last six months, and the erection of the superstructure is now begun. This bridge has the longest truss span —812 ft. between pier centers—yet completed in America and the third longest in the world. It completes the Wabash extension into Pittsburg and has been designed to carry the heaviest loads on both tracks and this together with the great length of span has necessitated the use of massive top and bottom chords and the strongest eyebars ever made. All of the members have been erected in the shop and the field connections reduced to a minimum. At the present time the travelers at both ends have been erected and all the steel work delivered on the ground.

The shore and anchorage piers are fine examples of concrete masonry. They are shown completed in the accompanying photographs. The shore piers are faced with sandstone ashlar in 2 ft. courses, backed with concrete with a central well. The top of the well is arched with concrete reinforced by two layers of 6 in. I beams at right angles to each other. The piers rest on caisson foundations 2 ft. below low water, the caissons being carried down 42 ft. to solid rock. The anchorage piers are smaller than the shore piers and are built entirely of concrete. They each consist of two monoliths resting on a single caisson foundation and united at the top by a concrete arch in which are embedded two layers of twisted steel square bars. The reaction platforms and lower anchor bars are embedded in the concrete. The upper anchor bars are free to move longitudinally in the well about the pin connection at their lower end.

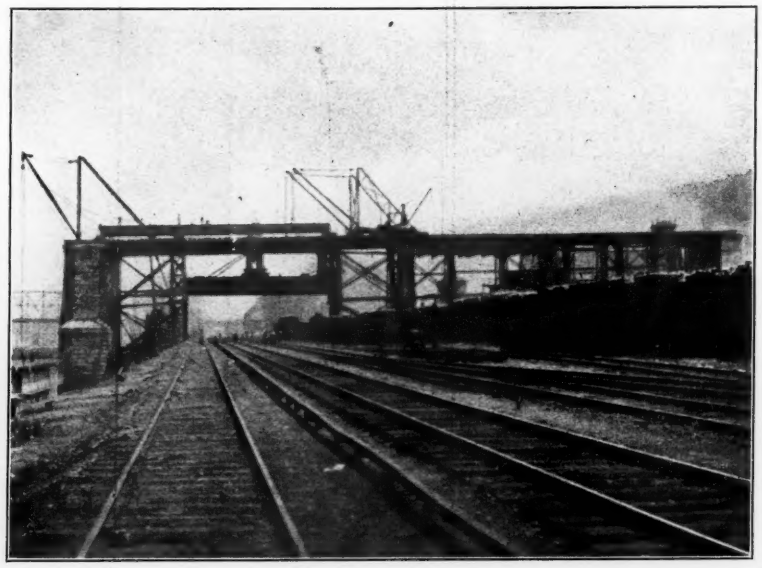
South Anchor Pier After Removing Concrete Molds. March 28, 1903.



South Shore Pier Looking Upstream. May 7, 1903.



Traveler Ready for the Erection of the North Anchor Arm. July 25, 1903.



Laying Floor System of South Anchor Arm. July 25, 1903.

The steel eyebars used in the superstructure have been made at the new eyebar plant of the American Bridge Co. at Ambridge, which company has the contract for the building and erection of the spans. The largest bars are 14 in. x 2 in. and no other plant in this country had the machinery for turning out such heavy work. As it is the capacity of the largest testing machine in the country at Phoenixville, N. J., will be severely taxed to break these bars. A number of tests have already been made on some of the smaller bars, 12 in. x $1^{13}/_{16}$ in. and 14 in. x $1^{9}/_{16}$ in., the results of which are given in the table herewith. In every case but one the specifications have been surpassed due to the careful attention given in annealing.

The specifications for the eyebars are as follows: Eyebars shall be rolled from ingots having at least 25 per cent. of the top cut off and exhibit no piping. Bars must be rolled down in one heat from the bloom, which must be of sufficient thickness to insure the proper amount of work in rolling and proper finishing temperature.

Specimens must be taken from the center and sides of the bars, and tested, annealed and unannealed; the cold unannealed bending tests to be made on pieces the full thickness of the bar.

The heads of eyebars and enlarged ends of rods shall be made by upsetting or forging into shape, by such process as will insure uniformity of product and be satisfactory to the engineer. Eyebars must be perfectly straight before boring and pin holes must be in the center of heads and on the axis of the bars. Eyebars of the same panel must permit of the insertion without driving of the pins at each end, when bars are laid together. Eyebars must be free from flaws, and must have the heads so proportioned as to develop the full strength of the bars, joining the bars in an easy curve. They must be bored to lengths not varying more than $^{1}/_{64}$ of an inch in 10 ft., nor more than $^{1}/_{32}$ of an inch for their entire length.

Eyebars, forgings or members of important parts reheated, must be carefully annealed with pure heat, free from destructive gases, before being machined. The annealing of full sized bars must be done with great care and with a pure flame, heating the bar throughout its full length uniformly, and to a temperature at which the steel shall become non-magnetic and not over 75 deg. above that temperature. It shall be held at this temperature only as long as it is necessary to acquire a uniform heat, and it shall be allowed to cool in the furnace to 570 Fah. or 300 Cent. for a time not exceeding 24 hours or less than 12 hours.

Eyebars that can be tested within the limits of the largest machines must show at least 12 per cent. elongation in 20 ft. and a yield point of not less than 30,000 lbs. per sq. in., with a breaking strength of 58,000 lbs. The number of bars to be tested must be representative of the sizes of the bars to be used and will be determined by the engineer. The contractor will pay for all bars failing to

FULL SIZE EYEBAR TESTS MONONGAHELA RIVER BRIDGE, PITTSBURG, PA. OPEN HEARTH BASIC STEEL MADE BY CARNEGIE STEEL CO. BARS MADE BY AMERICAN BRIDGE CO., AMBRIDGE PLANT, 1903. TESTED AT PHOENIX BRIDGE WORKS.

Test number	276	277	278	279	280	281	282	283	...	...
Heat number	47,061	34,640	31,619	31,617	47,159	36,668	35,023	34,560	47,201	31,626
Specimen tests (unannealed)—Elastic limit	44,070	38,260	36,190	38,270	37,660	38,540	38,340	39,760	45,280	40,004
Specimen tests (unannealed)—Breaking strain	75,880	68,060	65,740	67,920	67,990	70,000	68,040	69,360	74,880	70,620
Specimen tests (unannealed)—Elongation p. c. in 8 in.	24.5	25.0	27.5	25.0	25.0	26.0	26.5	26.2	22.5	24.2
Specimen tests (unannealed)—Reduced area, p. c.	40.1	38.6	41.4	38.6	38.8	39.9	45.3	40.0	25.4	41.9
Specimen tests (annealed)—Elastic limit	37,350	37,680	36,230	36,520	35,160	35,360	35,880	36,750	38,540	37,400
Specimen tests (annealed)—Breaking strain	68,640	64,330	62,500	66,580	60,340	63,720	63,880	64,360	69,729	63,300
Specimen tests (annealed)—Elongation p. c. in 8 in.	31.2	24.2	32.5	31.0	36.0	30.0	27.5	27.5	26.5	27.0
Specimen tests (annealed)—Reduced area, p. c.	55.9	53.9	56.1	47.8	54.5	54.9	60.1	56.1	38.1	57.0
Chemical analysis—C	.25	.26	.26	.26	.29	.26	.25	.22	.26	.24
Chemical analysis—P	.021	.017	.014	.026	.026	.029	.018	.029	.04	.034
Chemical analysis—Mn	.60	.50	.47	.57	.55	.60	.58	.54	.60	.59
Chemical analysis—S	.028	.025	.024	.029	.040	.026	.024	.034	.036	.025
Dimensions of full size bars—Mark	18 U.-19 U.N.	6 U.-7 U.	6 U.-7 U.	5 U.-6 U.	5 U.-6 U.	4 M.-5 U.	7 U.-8 U.	8 U.-9 U.	11 U.-12 U.	11 U.-12 U.
Dimensions of full size bars—Section...in.	12x1 ½	12x1 13/16	12x1 13/16	12x1 13/16	12x1 13/16	12x1 13/16	12x1 ¾	12x1 13/16	14x1 9/16	14x1 9/16
Dimensions of full size bars—Length, c. to c....ft. & in.	29—5	30—3 1/8	30—3 1/8	30—0 3/4	30—0 3/4	43—1 19/32	40—8 9/32	41—5 23/32	12—0	12—0
Dimensions of full size bars—Size of pin, A,...in.	10½	10½	10½	10½	10½	10½	10½	12	14	14
Dimensions of full size bars—Size of pin, B...in.	10½x16½	10½	10½	10½	10½	10½	10½	10½	14	14
Dimensions of full size bars—Size of head, A...in.	26½	26½	26½	26½	26½	26½	26½	28	33	33
Dimensions of full size bars—Size of head, B...in.	26½	26½	26½	26½	26½	26½	26½	26½	33	33
Dimensions of full size bars—Excess in heads, A....p. c.	43.4	34.6	36.4	38.0	35.2	39.3	40.1	40.6	38.0	33.95
Dimensions of full size bars—Excess in heads, B....p. c.	43.0	39.1	36.6	40.3	35.9	35.5	38.4	40.8	37.3	34.3
Full size bar tests—Elastic limit	36,140	33,900	30,140	35,720	32,950	34,340	31,240	31,500	38,750	36,675
Full size bar tests—Breaking strain	67,220	59,930	54,660	62,750	61,960	64,640	63,040	53,300	66,830	62,275
Full size bar tests—Reduction of area...p. c.	39.7	49.6	49.6	36.1	47.9	40.3	41.5	...	55.0	47.0
Full size bar tests—Elongation,...p. c. in 12 in.	37.0	45.0	47.0	49.0	40.0	36.0	41.0	..	45.0	44.0
Full size bar tests—Elongation, measured...ft.	25	26	26	26	26	39	37	37	8	8
Full size bar tests—Elongation, measured...p. c.	20.6	16.0	19.35	21.5	13.5	21.0	19.5	7.5	22.5	26.0
Full size bar tests—Elongation, pin holes, A...p. c.	26.8	29.3	34.8	27.2	27.6	26.6	23.2	...	25.5	36.9
Full size bar tests—Elongation, pin holes, B...p. c.	21.4	28.3	28.1	28.3	23.6	24.1	18.4	14.2	28.1	32.3
Character of fracture	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Remarks	*	...	...	...	...	...	...	†	...	...

[1] Silky angular. [2] Silky ½ cup. [3] 70 per cent. S. cup, 30 per cent. F. Gn. [4] Silky ½ cup. [5] 70 per cent. S. cup, 30 per cent. F. Gn. [6] Silky angular. [7] Silky angular. [8] 100 per cent. granular. [9] Silky cup. [10] Silky angular. *Elongated pin hole one end. † Broke in head.

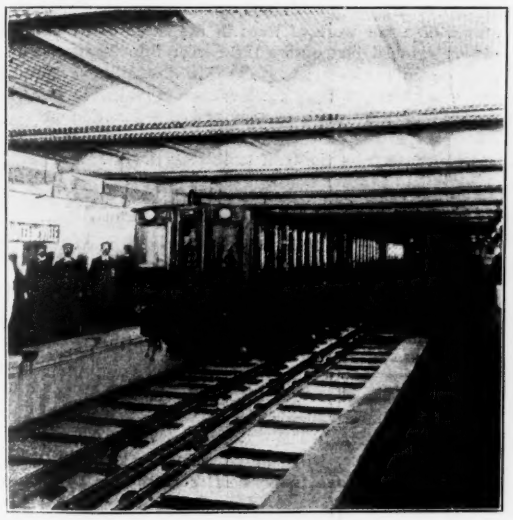
meet the requirements of this specification. Bars tested to destruction and fulfilling specification's requirements will be paid for at the cost of material and manufacture, less credit for the scrap value of the material. Bars which fail in the head and which otherwise meet the requirements of the specifications will not be cause for rejection of the lot, provided not more than one-third of the bars so break.

That clause of the specifications requiring the bars to be heated to a point beyond which steel loses its magnetism is one not found in most specifications, but the results of the tests seem to justify its insertion in specifications requiring the highest grade of uniform material. As will be seen from the table of tests the bars had an elastic limit averaging nearly 4,000 lbs. over the required limit and a similar excess in the ultimate strength. The elongation in some cases ran as high as 21 per cent., or an excess of 9 per cent. over the specification. The results of the two tests of 14 in. bars were equally as good as those for the 12 in. bars, which would indicate the thoroughness of the annealing. About one in every 25 bars have been tested which corresponds to one in every three or four heats, the inspector selecting the test bar from surface imperfections.

It is expected to have the bridge done by November. Demolishing the buildings on the site of the Wabash terminal at Pittsburg is practically completed and that portion of the project will soon be well under way. The tunnel under Mount Washington on the other side of the river has been driven through and the footings are now being laid. We are indebted to Messrs. Boller & Hodge, the consulting engineers, for the railroad company, for the photographs and information about the present state of the work.

Fire Calamity on the Paris Metropolitan.

At 8 o'clock in the evening, August 10, train No. 43 on the Metropolitan Electric Railway of Paris, which runs chiefly underground, came from Porte Dauphine at the entrance to the Bois de Boulogne, and, passing under the Place de l'Etoile, circled the northerly quarter of the city. This is a manufacturing section and the train was there loaded with workmen returning to their homes in the eastern part of the city after their day's work. The motor soon failed to act properly and the train halted at the station of Les Charonnes until a second train arrived and pushed the disabled train ahead of it, making



Characteristic Station, Showing Track and Third Rail.
From *Le Chemin de Fer Metropolitain Municipal de Paris.*

a total of 16 cars. After proceeding about 200 yards towards Menilmontant station the damaged motor set fire to the first train, causing dense smoke. The passengers, terror stricken, tried to make their way back through the tunnel to Les Charonnes, but were overcome by smoke and gas before they could reach the exits, while the confusion was increased by the fact that all the electric lights went out. Meantime, a third train crashed into the fire, adding more terrified passengers to those already seeking an outlet. One of the main causes of loss of life seems to have been the thronging of the victims at the wrong exit from the station, which was barred.

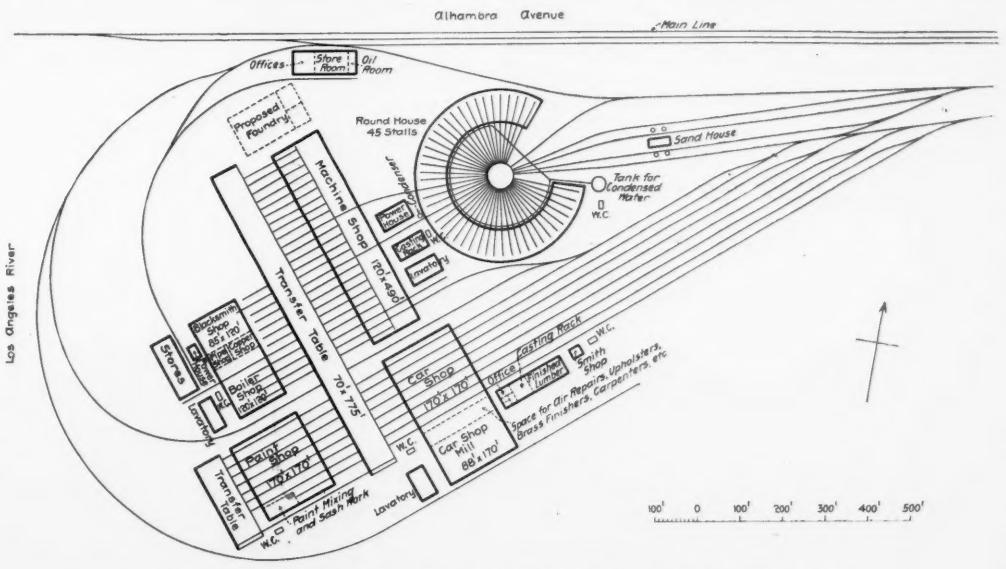
The cars continued to burn until 20 were consumed, and the heat was so intense and the smoke so stifling that the first successful descent was not made until after 3 o'clock in the morning; seven hours after the fire started. According to most recent advices at the time we go to press 84 bodies have been recovered, and it is thought that the death list will probably exceed 100.

According to press reports, the Secretary of War has approved the opinion of the Judge Advocate General of the Army, holding that the Government is entitled to reduced rates over the tracks of land grant railroads when operated by other railroad companies. The Astoria & Columbia River Railroad, which has trackage rights over 39 miles of the Northern Pacific in Oregon, refused the land grant rate to the War Department and the Attorney General has been requested to bring suit to recover extra charges paid by the Government.

The Southern Pacific Shops at East Los Angeles.

Early last year the Southern Pacific began work at East Los Angeles, Cal., on new shops located on the main line of the road at the intersection of Alhambra avenue and the Los Angeles River. The original plans provided for a boiler and blacksmith shop, 120 ft. x 250 ft.; machine and erecting shop, 120 ft. x 250 ft., having 12 pits; car repair shop, 85 ft. x 300 ft.; car paint shop, 85 ft. x 300 ft.; transfer table, 70 ft. x 600 ft.; 40-stall roundhouse; boiler material building, 50 ft. x 150 ft.; minor buildings for offices, stores, etc.; double-track steel bridge across the Los Angeles River at Alhambra avenue; freight receiving depot, 50 ft. x 600 ft., and several thousand feet of new trackage for switching and shop purposes; the estimated cost to be $400,000. Construction was first begun on the roundhouse, machine and erecting and boiler and blacksmith shops and transfer table, but before their completion the plans were modified, the machine and erecting shop being doubled in size, the transfer table extended to correspond, the car repair and car paint shops changed to the dimensions shown on the plan, and a small transfer-table added to serve the latter.

The entrance to the shops and roundhouse tracks is from the northeast over two leads. Five separate tracks lead to the turn-table, to permit freedom in receiving and



General Plan of Southern Pacific Shops at East Los Angeles.

despatching engines. Connecting to one of the turntable tracks is a belt line running around the shop tract, with branches leading to the transfer table, boiler material store building, and to the main line to give entrance from the northwest.

The shops are built with the cross-track arrangement, the buildings being on opposite sides of one long transfer-table, with an additional small transfer-table for the car paint shop. The erecting shop has a 100-ton overhead, traversing crane. The shop buildings are brick and steel, on brick and concrete foundations, with pitch and gravel roofs, except the office, general store and oil building, which has a slate roof.

The machine and erecting shop is a three-bay building, 490 ft. x 120 ft. Each department occupies one-half of the building, or 26,400 sq. ft. of floor space. The floor space per erecting pit for each department is 1,225 sq. ft., or a total of 2,450 sq. ft. per erecting pit for the building. The boiler shop (120 ft. x 120 ft.) has 600 sq. ft. of floor space per erecting pit, and the blacksmith shop (85 ft. x 120 ft.) 425 sq. ft. per pit, making the total for these four main departments 3,475 sq. ft. of floor space per erecting pit.

The track arrangement in the machine and erecting shop is unusual. All pit tracks connect with a central longitudinal track which runs the length of the building but does not extend outside. At the intersections of all cross and longitudinal tracks are placed air lifts with tops flush with the floor to serve as turntables. Under the second and third tracks from the south end are drop-pits for driving and truck wheels, and a duplicate arrangement is also provided under the 14th and 15th tracks from the same end, the first of which tracks leads to the roundhouse.

The machine shop has not yet received the full complement of tools, there being considerable space at the north end for future additions. Those already installed are separated into five groups for motor driving. Groups A and B are for wheel work, and are arranged for handling the work with rapidity and convenince. Two tracks from the outside enter the shop between these groups, from the south one of which two wheel-press tracks run off at right angles to a 50 and 75-ton wheel press respectively. At right angles to the other of these tracks is the track for driving wheels, one end of which serves the 300-ton wheel press, and the other the driving wheel lathes and the quartering machine. This track is equipped with its own 10-ton electric traveling crane.

Group C comprises most of the larger cutting, turning and grinding machines not found in the first two groups. Group D is for bolts and small work, and group E contains the stud and brass machines, drills and some cutting tools. There are two individually-driven tools, one a quartering machine in group B, requiring a 7½ h.p. motor, and the other a 72-in. planer in group C, with 20 h.p. motor. Group C is served by two four-ton self-supporting compound air cranes, one of 18 ft. and the other or 14 ft. reach.

The boiler, blacksmith, copper and pipe shops are all under one roof, the building being 250 ft. x 120 ft. The pipe and copper shops occupy a strip 45 ft. wide between the larger departments, the two being separated by a communicating passage between the latter. The boiler shop has five tracks, one of which extends back to the boiler material storehouse. The tracks are served by a 30-ton overhead traveling crane. The equipment includes a 16-ft. bending rolls, and a heavy combined punch and shears, both individually motor-driven. The remaining tools are driven from a motor-driven line-shaft.

The lighter tools in the blacksmith shop are also belted to a motor-driven line-shaft. The heavy tools include two steam hammers of 1,200 and 1,500 lbs. capacity, respectively. The shop is provided with three four-ton, 18-ft. compound pneumatic cranes.

The car repair and paint shops are both three-bay buildings with monitors having side-lights and skylights, and double rows of skylights over the side bays. The car repair shop has a 3 in. x 8 in. rabbeted cedar floor, and the paint shop a cement floor, 4 in. thick. The car repair shop is 170 ft. x 170 ft., with eight tracks, giving room for 16 long coaches. The south end of the building is the mill, 88 ft. x 170 ft., and between the mill and car repair shop is a section 59 ft. x 170 ft., partitioned into four small rooms. One of these, 59 ft. x 41 ft., is for repairs to air-brake equipment; the second, 59 ft. x 32 ft., is for cabinet work; the third, 59 ft. x 32 ft., is for a tin shop; and the fourth, 59 ft. x 64 ft., is for upholstering. Leading from the latter to an upper room occupying the middle bay, is a stairway and also an elevator. This latter room is also used for upholstering, and by the tinners and brass finishers.

The radius of the roundhouse to the outside wall is 205 ft., the stalls being 80 ft. deep, and the inside radius therefore 125 ft. The construction is not similar to the shop buildings, timber columns and framing supporting the roof, which slopes each way from the center. Six stalls of the house are used as a locomotive paint shop, leaving 34 available for terminal purposes. The turntable is 70 ft. in diameter and is electrically driven. Two tracks connect the roundhouse and machine shop.

The roundhouse is provided with an arrangement for saving and storing condensed steam and water from the locomotive boilers. Each pit, except those in the paint shop, has near its center, provision for connecting the locomotive boiler to a 2-in. pipe, which connects to a 6-in. pipe running around the house just outside of the inner wall. This 6-in. pipe leads to a large tank at one side of the entrance to the roundhouse, into which the water is elevated by an automatic air-lift. There is also an overhead pipe, carried by the roof framing, for connection to the steam domes, and which leads to a condenser placed outside of the house at the back.

The offices, general storehouse and oil room all occupy one building, conveniently placed for receipt and distribution of stores and oil. The building is brick with slate roof, 155 ft. x 63 ft., the oil room, occupying 26 ft. of its length, the store room 74 ft., and the offices the rest. The belt line encircling the shop tract passes along one side of the store house, and a track on the opposite side runs to the boiler material store building, with a cross-over to the belt track.

Large and convenient lavatories have been provided, two for the locomotive and one for the car department. Each contains 160 wash basins, 372 lockers and 372 bicycle racks. It is expected later to build a foundry north of the machine and erecting shop, between it and the belt tracks. The blueprints from which the drawings and information were obtained were sent by Mr. H. J. Small, General Superintendent of Motive Power.

Grade Reduction on the Illinois Central.

The geographical location of the Illinois Central, with a main line running due south from the Great Lakes to the Gulf of Mexico and branches west from Chicago to the Missouri River, gives it a physically advantageous position among American trunk lines. Although starting in the great grain territory and terminating at the seaboard, it has no extensive range of mountains to cross or to avoid, as do the east and west lines. Furthermore, instead of an uncertain back haul for the cars which have carried grain or coal to the seaboard, the Illinois Central in connection with its proprietary line, the Yazoo & Mississippi Valley, reaches a center of bulky northbound freight which is located close to the outlet of the bulky southbound freight, and the cars which carry grain south are left at the right place to carry cotton and lumber north. The fruit trade of the Gulf of Mexico furnishes also a large northbound business in addition to lumber, and to the import goods brought to New Orleans by the grain ships. The excellent facilities at the company's Stuyvesant docks, near the mouth of the Mississippi, where lighterage is unnecessary, have been a considerable development of recent years, and the grain export business is rapidly increasing. In the fiscal year ended June 30, 1902, New Orleans stood fifth among American ports in the quantity of grain exported, but has risen in the last year to third place, following New York and Baltimore. A statement recently issued by the Maritime & Merchants' Exchange reports 31,126,456 bushels of grain as cleared from the port during the year ended last June, and comment is made that a large percentage of this grain was formerly shipped to the Atlantic Seaboard.

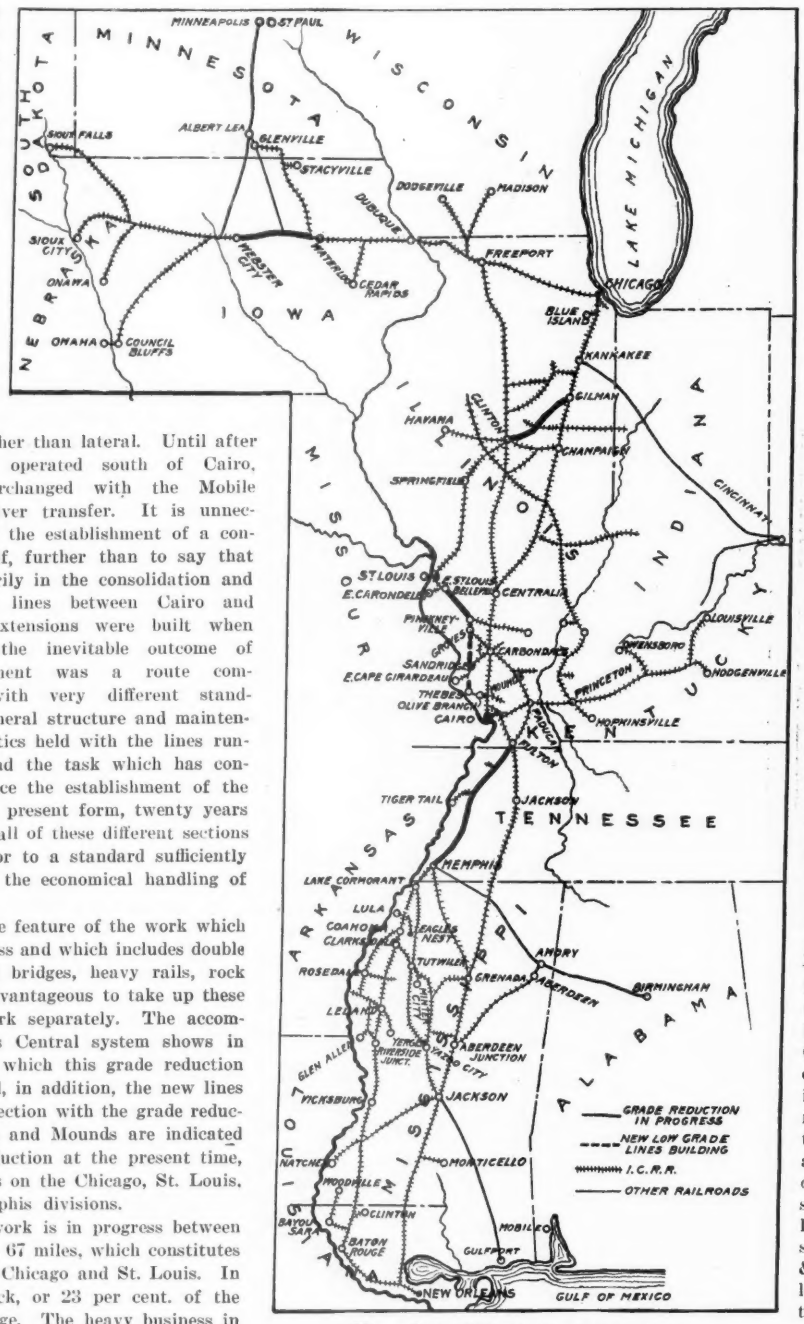
Although the Illinois Central Railroad, which was chartered in 1851, is among the oldest of American railroads, it is only in comparatively recent years that it has established a through route to seaboard, and it is in this respect unlike most east-and-west trunk lines, in that its most important extensions have been straightaway, rather than lateral. Until after 1872 the road was not operated south of Cairo, where business was interchanged with the Mobile & Ohio by means of a river transfer. It is unnecessary to go into details of the establishment of a connection through to the Gulf, further than to say that the process consisted primarily in the consolidation and absorption of independent lines between Cairo and New Orleans, and that extensions were built when they were needed. But the inevitable outcome of this process of development was a route composed of odd sections with very different standards of grade, curvature, general structure and maintenance. The same characteristics held with the lines running west from Chicago, and the task which has confronted the management since the establishment of the system in something like its present form, twenty years or so ago, has been to bring all of these different sections up to a uniform standard, or to a standard sufficiently uniform so as to permit of the economical handling of through traffic.

Grade reduction is only one feature of the work which has been constantly in progress and which includes double tracking, new buildings and bridges, heavy rails, rock ballast, etc., but it will be advantageous to take up these different branches of the work separately. The accompanying map of the Illinois Central system shows in heavy lines the territory on which this grade reduction work is now in progress, and, in addition, the new lines which are being built in connection with the grade reduction work between St. Louis and Mounds are indicated by a broken line. Grade reduction at the present time, as will be seen, is in progress on the Chicago, St. Louis, Omaha, Tennessee and Memphis divisions.

On the Chicago division, work is in progress between Gilman, Ill., and Clinton, Ill., 67 miles, which constitutes a portion of the line between Chicago and St. Louis. In this section 16 miles of track, or 23 per cent. of the entire line, will undergo change. The heavy business in this district is northbound and the ruling gradient is now 53 ft. per mile. When the indicated changes have been made, a ruling gradient of 21 ft. per mile against northbound traffic will be established. The reduction is made entirely on the present alinement, on which the maximum curvature is 2½ deg. The proposed change will not reduce the curvature, but compensation will be made. The tonnage rate is now 970 tons for the heaviest engines assigned to that district, and this will be increased to 1,400 tons, which is an increase of 32 per cent. The work involves the removal of approximately 300,000 cu. yds. of earth, and all bridges affected are being put in of permanent design, with concrete as standard for all masonry structures, and iron pipe used where the regular water way does not exceed the area of a diameter of 48 in. On the Chicago division, a total of about 495 ft. vertical grade will be taken out, and work is being done at 15 separate points.

On the St. Louis division grades are being reduced between Belleville, Ill., and Pinckneyville, and several new lines are also building to avoid heavy existing grades. Belleville is about 14 miles south of St. Louis, and Pinckneyville is 48 miles distant from it; the actual track affected being approximately 26 miles, or a little less than half of the territory. The present ruling grade is 53 ft. per mile, and this will be reduced for traffic in both directions to a maximum of 26.4 ft. per mile. The work involves removing 470,000 cu. yds. of earth, about one-third of which is handled by steam shovels. The changes are being made entirely on the present alinement with compensation for all curves. This stretch of grade reduction together with new lines mentioned above, will afford a low grade line from Belleville to the south with the ultimate plan of diverting the business which now goes south from St. Louis by way of Carbondale to Mounds, to, and via the new lines to the latter point. Mounds is the principal receiving and distributing yard for the entire Illinois Central business between the northern and southern lines. These improvements will raise the tonnage rating in this territory from 1,220 tons, for the heaviest locomotive, to 1,720 tons. The maximum curvature will remain unchanged, but the grades affected will be compensated.

As shown by the map, the new lines which are building in the St. Louis territory start at Groves, Ill., 9 miles below Pinckneyville. A line 18 miles long will reach a point known as Sand Ridge on the route from Carbondale to Gale. From Gale to Thebes, a new line two miles long has been built, connecting with the Chicago & Eastern Illinois, and a traffic arrangement has been made with the latter company for the use of its tracks between Thebes and Olive Branch, eight miles. Starting again at Olive Branch a new line is now almost completed to Mounds, Ill., 10 miles further. The line thus completed will be approximately the same length as the existing line from Belleville to Mounds, but it will effect a reduction in grade from a maximum of 40 ft. per mile uncompensated, of a maximum curvature of 4 deg., to a maximum grade of 26 ft. per mile, with compensated curves. The new route takes away all through St. Louis business from the line between Carbondale and Mounds, which is of comparatively heavy grade and curvature.



Map of the Illinois Central System.

On the Omaha division grade work is in progress between Waterloo and Fort Dodge, Iowa, on the Chicago & Omaha line, and the amount of track affected by the present work is about 32 miles, or a little less than a third of the entire distance between the above-mentioned points. Between Cedar Falls and New Hartford a new line approximately 10 miles long is being built entirely independent of the line now in use. The cut-off will avoid a considerable curve and will take off 44 ft. from the maximum grade between these two points against westbound traffic and 18.6 ft. against eastbound traffic. The sharpest grade between Waterloo and Fort Dodge is now 48 ft. at a point near Fort Dodge, which is approached by a descending grade of 36 ft. The reduction is being made to a maximum of 26.4 ft. per mile, except for a few momentum grades less than 1,000 ft. long, and one descending grade immediately east of Fort Dodge. When the present work is completed, 28 grades of 40 ft. or more will have been taken out. The list of grades removed includes one 71-ft. grade nearly 2½ miles long, four other grades of over 50 ft. and twelve grades of 45 ft. or over. The Chicago-Omaha line will then be of low grade from Chicago to Freeport and from Waterloo to Omaha, representing approximately 70 per cent. of the line, and the tonnage of the largest locomotive assigned to that district will be increased from 1,050 tons to 1,400 tons. Between Freeport and Waterloo, no reduction is being made. The crossing of the Mississippi River at Dubuque involves a long and severe grade at each side of the river, and it is not likely that this can be much improved, at least for the present. In addition to the grade, the line on the west side has a maximum of 6 deg. curvature; otherwise, the maximum curvature is 5 deg. Between Dubuque and Waterloo the maximum grade at present is about 80 ft. per mile, but on the other side of the river, between Dubuque and Freeport, it does not exceed 43 ft.

On the Tennessee division grade reduction work is in progress between Fulton, Ky., where the two routes north and south cross, and Memphis, Tenn. This territory is part of the main line between Chicago and New Orleans and the track between Fulton and Memphis was originally built as a portion of the Huntington Transcontinental project, and was known as the Chesapeake, Ohio & South-Western and was obtained by the Illinois Central in 1896 to provide a northern outlet for the Yazoo & Mississippi Valley, which until that time consisted of a net work of lines in the State of Mississippi, which reached just across the border into Tennessee and terminated at Memphis. The low prevailing grades on these Mississippi lines render them a valuable asset as portion of a through system and the junction between Memphis and Fulton completed what is practically a double route from the Gulf to the Northwest. The grades against southbound traffic were reduced in this territory two years ago and work is now being directed against northbound traffic. The grades on the old Chesapeake, Ohio & South-Western were pretty sharp, and at the present time the maximum against northbound is about 58 ft. with a grade of 87 ft. (against southbound), a grade of 86 ft. and a grade of 63 ft. against northbound traffic in the city of Memphis. Work is now being done on a basis of 26.4 ft. per mile and covers a territory of 120 miles, changes on 23.32 miles being effected without changing the present alinement while 6.24 are changed by diversion of the line, reducing the curvature materially where the line is diverted. The maximum gradient for the entire district, however, will not be reduced at present. The work is being done in connection with double-tracking, which will be taken up in a separate article, and permanent bridge work is being put in wherever possible. When the present work is completed and the low grade lines south of Memphis are finished, the entire line between Chicago and New Orleans, via Memphis, will be low grade except at one point between Carbondale and Cairo, where the line crosses the extension of the chain of mountains known as the Ozark Range, over which it is not practicable to reduce grades below the present maximum of 40 ft. per mile. On the line of the Illinois Central Railroad, however, figures of maximum gradient and curvature are misleading, as they do not take into consideration the remarkable series of tangents in Mississippi on the southern lines and in Iowa on the western lines, and such figures do not give credit to the long stretches almost at water level on portions of the Yazoo & Mississippi Valley. For example, between New Orleans and the Louisiana-Mississippi State line at Wilson the ruling grade on the Y. & M. V. is practically 10 ft. per mile.

Taken as a whole, therefore, the Illinois Central is in excellent shape to handle a continuous and heavy traffic in both directions. The capacity of the lines will be taken up more in detail in a future article on the double-track work; it is sufficient to say at the present time that the road is singularly free from congestion of freight. Starting with certain natural advantages in the way of geographical location and with certain disadvantages occasioned by the method in which it was necessary to build the system up, the officers have worked with great perseverance and great success towards the handling of maximum loads and the expeditious movement of through traffic.

We are especially indebted to Mr. W. J. Harahan, Assistant General Manager, and to Mr. H. U. Wallace, Chief Engineer, for assistance in preparation of this article.

The Detection of the Finishing Temperatures of Steel Rails by the Thermo-Magnetic Selector.

BY ALBERT SAUVEUR AND JASPER WHITING.

When a piece of steel is allowed to cool undisturbedly from a high temperature, it crystallizes, and the resulting crystals or grains, as they are frequently called, are the larger, the higher the initial temperature and the slower the cooling. If steel be vigorously worked (rolled or forged) while it is cooling from a high temperature, crystallization is prevented, but as soon as work ceases, crystallization sets in until a certain temperature is reached,

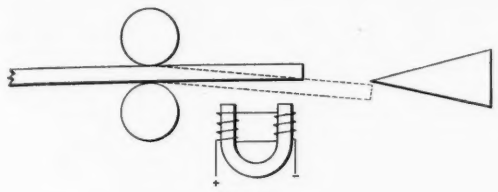


Fig. 1.

which in the majority of cases is not far from 700 deg. C., and below which there is no further growth of crystals.

We may, for convenience, call the range of temperature during which steel crystallizes, and which extends from the melting point to this critical temperature the crystallizing range. In working steel, as is done in the manufacture of so many implements, from a high to a much lower temperature, crystallization is retarded, i.e., is made up to cover a much shorter range of temperature, extending from the finishing temperature (the temperature at which work ceases) to the critical temperature. The resulting structure will, therefore, be finer grained, i.e., will be made up of smaller crystals than if the metal had been allowed to cool undisturbedly from a higher temperature. The crystals will be the smaller the lower the finishing temperature.

The finer the structure, that is, the smaller the crystals, the more ductile will be the steel, and since ductility is always a very desirable property, whatever the intended use of the finished implement, we should so conduct the treatment of the metal as to confer upon it the finest possible structure. The importance of finishing steel implements at the proper temperature, therefore, need not be insisted upon. It is now appreciated by all enlightened metallurgists.

The manufacturers of steel rails, more than any other

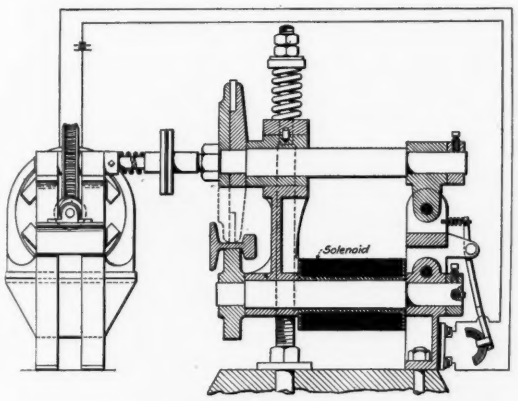


Fig. 3.

producers of finished steel articles, have given careful attention to the important influence of the finishing temperature upon the structure and the physical properties of their rails. In these days when the tendency is to allow more and more carbon in rail steel, in order to lengthen the life of the rail, the importance of securing all the ductility possible from the heat treatment stands pre-eminently first.

If a satisfactory means could be devised to ascertain whether or not rails are finished at the proper temperature, rail consumers would specify the application of such a test and would thereby obtain rails of a better and more uniform quality. Several methods have been proposed to this end, that have been tried tentatively, but none has proved satisfactory. Efforts have been made to determine the finishing temperature, (1) by the use of pyrometers, (2) by the shrinkage of the rails after leaving the finishing rolls, and (3) by the examination of the microstructure of the rails. The use of pyrometers naturally suggested itself at first as the most promising means of accomplishing that purpose, but it was soon found that no pyrometric device existed which could be applied in a practical way to the detection of the temperature of quickly moving rails. The control of the finishing temperature by the amount of contraction which the rail undergoes in cooling from the finishing to the atmospheric temperature is open to serious objections. The micro test, although attractive and useful, can only be applied to a very small percentage of the rails manufactured, and this is its greatest weakness.

A practical and efficient method of preventing the rolling of coarsely crystalline rails should fulfil the following requirements: (1) It should be continuous in its working, it should test every rail; (2) its working should be automatic; (3) it should not interfere with the speed or simplicity of the mill operations, and (4) the cost of its installation, maintenance and operation should not be excessive. The method described below appears to fulfil these requirements.

When steel is heated to a high temperature it loses its magnetic properties. On cooling the metal remains non-magnetic until a certain critical temperature is reached, when it regains its magnetism quite abruptly. In the case of medium high and of high carbon steel this change in the magnetic properties occurs at the well-known point of recalescence which also precisely marks the end of the crystallizing range. It is evident, therefore, that steel rails, in order to have a fine structure,

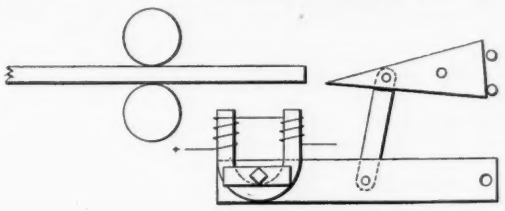


Fig. 2.

should be magnetic shortly after leaving the rolls, because this would indicate that they were finished but slightly, if at all, above the point of recalescence.

These considerations suggest the application of a magnetic test to the control of finishing temperatures of steel implements. Various methods of applying the magnetic test might be used. In order to be effective and practical, however, the mechanism should be automatic and actuated solely by the magnetic properties of the finished implements. These automatic devices may be grouped into two classes:

(1) The automatic separation of magnetic from non-magnetic rails, through the deflection of the magnetic rails brought about by the deflection of the magnetic rails themselves due to the attractive influence of a magnet or by the motion of a suitable deflector placed in their path and which is controlled by the motion of a magnet, actuated in turn by the magnetic conditions of the rails. These two arrangements are indicated in a conventional manner respectively in Figs. 1 and 2. It will be evident that the magnetic device instead of being placed in close proximity to the rolls may be located at some other points near the hot saws, for instance.

(2) The automatic stamping of magnetic rails to the exclusion of others, or vice versa.

This method appears to be the more practical of the two, and it will suffice to describe only that arrangement which after careful study of the problem involved has seemed to be the most promising.

The device illustrated in Fig. 3 consists of a rail stamping machine of the usual design, arranged to place in the runway from the hot saws. The rails pass over two rollers keyed on to steel shafts extended back to the frame of the machine. To the rear of the frame is attached a steel keeper and bridge piece. This keeper is supported on a pin in such a way that if the two steel shafts become magnetized, it will be attracted and drawn down against the ends of the shafts. The tendency to magnetic attraction is resisted by a spring which serves the purpose of drawing the keeper away from the ends of the magnet as soon as the shaft ends forming the magnet poles become so weak as to have less influence on the keeper than the spring. The two solenoid spools are intended to be energized by means of an electric current the connections of which are not shown. The action of the machine is as follows: When a rail which is cold enough to be magnetic passes over the two rollers it closes the air gap between the rollers, and by the closing of this air gap the magnetic flux which is passing through the steel shafts due to the current flowing in the solenoid is increased many times. By thus connecting the two steel shafts by means of a magnetic rail, a horse-shoe magnet is formed with the poles at the rear of the machine. This increase in flux causes the keeper and bridge piece to be attracted, thus forming a complete magnetic circuit through the two steel shafts, the rail and the keeper. As soon as the keeper is attracted it closes the electric switch, which establishes a circuit through an electric motor, which in turn revolves the shaft carrying the stamp, thereby causing the stamping of the magnetic rail. The stamping mechanism is briefly as follows: The motor acting through the worm and gear rotates the shaft and the resulting movement of the die wheel brings the first character against the rail, after which the movement of the rail past the die wheel rotates the latter positively until the last character passes out of engagement with the rail. The purpose of the friction clutch is to provide for differences in the relative speeds of the motor and rail and to permit the rotation of the shaft to come wholly under the control of the rail after the die has been brought into engagement with the rail through the medium of the friction clutch.

As soon as the rail leaves the rollers the spring returns the armature to normal position, thus opening the circuit and stopping the motor.

New York Central Track Plans.

The contract for depressing the tracks in the yard of the New York Central & Hudson River R. R., from 57th street south, has been let to the O'Rourke Engineering & Construction Co. The depression of the main tracks is to be about 10 ft. below the present level, and 25 ft. below that will be another set of tracks. This will open all the cross-town trains to traffic at the street level, and the second line of tracks will do away with the present crowding which exists at the terminal. According to the terms of the contract, the work must be completed within two and one-half years. The work has been divided into three sections, the first comprising the area from 45th to 50th street, east of the present yards and the subway under the eastern part of Park avenue; the second extending from 42nd street to 57th street, including a portion of the sub-station which is to be built at 42nd street to connect with the Rapid Transit tunnel; and the third taking in the balance of the work, including the west side of Park avenue. The present tracks which run from 56th street, where the tunnel begins, will reach the Grand Central terminal through an open cut. This line will be four tracks wide and will be used especially for the main passenger traffic, while 30 ft. below a tunnel 10 tracks wide will be built to accommodate the suburban trains. The underground tunnel tracks will reach the surface at 50th street by a 2 per cent. grade. Work is to be begun within a few days. For description of terminal changes see our issue June 5, p. 392.

Application for Delay Granted.

At a hearing before the Interstate Commerce Commission at Washington, Aug. 6, the application made by the Denver & Rio Grande, the Boston & Maine, the Pennsylvania, the Erie, and other roads, asking for an extension of time in which to comply with the Safety Appliance Act, was granted.

Commissioner Knapp, in summing up the evidence that had been placed before the commission, stated that the contention of inability to comply with the law requiring the roads to be equipped with safety appliances seemed to be summed up under four heads. The Denver & Rio Grande wanted an extension of time, claiming that the air-brake with which they were required to equip their cars was more dangerous to employees on their narrow-gage roads than another brake which they had substituted in its place. The Boston & Maine desired an extension with reference to cars and locomotives of its passenger equipment.

The Atchison, Topeka & Santa Fe had made an application in relation to the location of grab irons on its locomotives. The Pennsylvania and allied lines, the Erie and allied roads, including the Norfolk & Western, desired an extension in regard to the requirement for the equipment of 50 per cent. of its cars.

Mr. P. H. Morrissey, Grand Master of the Brotherhood of Locomotive Trainmen, made an extended statement as to the attitude of railroad employees toward these specific questions relating to extensions. The first law on this subject had been passed 10 years ago, after a campaign waged for nine years previous to that time, and yet the roads have not complied with the law. He wished to take a broad view of the question and at the same time to do nothing that would add to annoying delay.

J. T. Chamberlain, of Boston, Master Car Builder of the Boston & Maine, testified that his company has 500 cars still unequipped, and would want seven months to equip them.

The Atchison, Topeka & Santa Fe Railroad asked that the requirement of grab-irons on front or sides of road engines be dispensed with or else that the time for such equipment be extended.

Commissioner Knapp announced as the decision of the commission that the time for compliance would be extended from September first to October fifteenth, and that before the latter date, a ruling would be made on applications for further extensions.

New Record for Fast Time Between Chicago and the Coast.

The passenger department of the Atchison, Topeka & Santa Fe has sent out an account of the "Lowe Special" which last week established a new record for fast time between Chicago and the Pacific Coast. Mr. Henry P. Lowe, Chief Engineer of the United States Steel Corporation, learned on Tuesday, August 7, of the fatal illness of his daughter in Los Angeles, Cal., and immediately left New York on the "Twentieth Century Limited" of the New York Central. Arrangements for a special train over the Santa Fe were made by wire en route, and the train was in waiting when Mr. Lowe arrived in Chicago.

It left the Dearborn Station at 10:17 a.m., 23 minutes after the arrival of the "Twentieth Century Limited" at the Lake Shore station. It was composed of the hotel car "Rocket," a baggage car and an engine, and was given right of way to the coast, only stopping for water and coal, and to change engines and crews. It was scheduled to reach Los Angeles at 10:30 p.m. Friday. It arrived at 1:06 p.m., 9 hours and 24 minutes ahead of time, making the actual time from Chicago to Los Angeles, 2,267 miles, 52 hours and 49 minutes, allowing two hours for the difference in time. This is 15 hours and 16 minutes better than the time of the "California Limited" of the Santa Fe, and is an average of 42.8 miles an hour. The total actual time from New York to Los Angeles, 3,246.6 miles, was 73 hours and 21 minutes.

Previous fast runs between the Pacific Coast and Chicago were the "Peacock Special," Los Angeles to Chicago in 1900, at an average speed of 41.7 miles an hour, and the "Nellie Bly Special," San Francisco to Chicago, in 69 hours, at an average speed of 37⅛ miles an hour.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 83 Fulton Street, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The present period in railroad development is characterized by extensive rebuilding and betterment of existing lines, rather than by the opening up of much new territory. The *Railroad Gazette* has described, within the last year or so, this rebuilding of a number of trunk lines—the Pennsylvania doing work equivalent to the building of many railroads, in its efforts to provide outlet for its enormous traffic; the Baltimore & Ohio, cutting down mountain grades; the Norfolk & Western and the Lackawanna, providing for handling modern rolling stock. With the current issue, a series of articles on the Illinois Central is begun. Owing to important differences in geographical location and in the way in which the business was built up, the officers have encountered a series of problems quite different from those of the roads previously mentioned, in their efforts towards unification and betterment. Instead of doing battle with mountains, the Illinois Central has a river to fight. The through route north and south, and also west from Chicago, has been made up of a number of railroads, built on a variety of standards, and all of these are being harmonized and made one. Moreover, the extensions south of Cairo, a fundamental part of the system as it exists to-day, have been a development of comparatively recent years. Yet, from all these different and complex units, a system has been formed which is a series of low grade lines, collecting the produce of the northwest for delivery at the Gulf, and rounding up, for back haul, the cotton and lumber of the Gulf States for delivery at Chicago. Unique in the fact that it connects the Great Lakes with the seaboard by a line unhindered by mountain ranges, and that it has a bulky haul both ways between terminals, the Illinois Central has an exceptionally strong position among the trunk lines of the country.

The trade unions are having an exposure of that which has been a besetting sin of spokesmen since the ancient oracles interceded with the gods on behalf of their worshippers. In the old time those who had been put wise knew that fruits and wine and gold and silver laid at the temple would bring an utterance proportioned to the offering. The gold and silver disappeared and the deluded ones did the behest of the oracle thinking it the voice of God. When the modern emblems of gold and silver, certified checks, were placed before Sam Parks, the Delphic oracle of the Housesmiths', Bridgemen's & Structural Iron Workers' Union, he called off a strike and said that the "men could go to hell." Richard Carvel, business agent of the Derrickmen's, Riggers' & Pointers' Union has a regular arrangement with a bartender to receive extortion money paid by employers to avert strikes. Lawrence Murphy, Stone Cutters' Union, got and got away with $10,000 extorted from contractor Baird, in Brooklyn. The curious accompaniment is that blackmailing delegates and agents are not repudiated by their unions but are upheld by them. The constitutions of most of the trade unions provide that a strike shall not be made until there has been mediation and an attempt to settle the difficulty by the shop or factory committee, then by the officers of the local union and finally by the officers of the national union, and yet unions generally (other than those of the grade of locomotive engineers and firemen) are dominated by ignorant and lawless blackguards of unusual ability. A beggar on horseback is not apt to become a trooper; he becomes a guerilla, an enemy to society, an anarchist. These guerillas plainly have control of the International Association of Machinists, who oppose the piece-price system and who, by sympathetic strikes and violence, have earned infamy by encouraging the idle and vicious and injuring the honest workmen. The educational training and studious habit of these gentlemen which gives weight to their judgment on economic questions is shown by the following exact copy of a letter received by the Carborundum Company, of Niagara Falls:

International Association of Machinists, Lansing Lodge, No. 384.
Office of Secretary, 806 Chestnut St., South Lansing, Mich., June 12, 1903.

To the Carborundum Company, Sir.
having receaved a commucion frome the Powre City Lodge 316 and stating the condicions and the way your Company is yousing Organized Labor Has cosed our Local Lodge to pas the folling resolutions that all members of Lansing City Lodge 384 of I.A Of M do hearby postolvy refuse to youse your producks in eany shop in this City as long as your unfair to Organized Labor.

Yours Fraternally,
Floyd S. Potter,
Recording Secretary.

P.S. your Company had better take a little advice frome thoes gone before like the U.P. strike whear millions of Dollars was lost and the Company beat at last and glad to give in.

Two phases of the electric traction situation are found elsewhere in this issue. One of them is a news paragraph stating that the attorney for a steam road in Indiana has asked for a reduction of $500 a mile in the tax assessment on the ground that for many miles the road is paralleled by competing electric roads which have injured the business of the steam road to the extent of the reduction asked for. The other is a description of a new type of sleeping car to be operated over the electric line from Indianapolis, Ind., to Columbus, Ohio, 190 miles. The interurban electric roads are building up an enormous traffic in the Middle West. In the States of Indiana, Illinois and Ohio all of the important towns and cities with the exception of those on the Lakes or the Ohio River, have been built up by the railroads. When the electric interurban lines came into the territory there were no profitable routes through non-railroad towns and the projectors of the new roads naturally built their lines to connect with the already prosperous cities. The most feasible routes through this country are those of shortest distance where there are few natural obstructions requiring long detours or expensive construction. The electric roads in buying rights of way, for very few run on the public highways, secured in most cases a line parallel to the steam road and oftentimes close to its competitor's line for the entire distance. On a map of this region the two competing methods of transportation can hardly be distinguished between such points as the electric roads have already been built. So far, the loss to the railroad companies has only been in local traffic, and, as is always the case, the new roads have created a large additional traffic over that taken away from the steam roads. Such a competition is not a permanent menace to the prosperity of the steam roads since it builds up a community from which they reap the benefit of the resulting large volume of freight and through passenger business. The electric roads, however, are not satisfied with their lion's share of the local passenger business, and by consolidation and traffic agreements have inaugurated competition with the steam roads for business for distances of 150 miles or over. Nor is this all; they have put in operation a package freight service which is to the local freight business what their passenger accommodations are to the local passenger business. Low rates and frequent service is the weapon of the electric lines in their fight for a foothold. The running of sleeping cars is only another move to take from the steam roads more and more of their traffic. Such cars as have been described will provide every comfort and convenience for the traveling public at a substantial saving in fares, and there is no question but what they will be liberally patronized. The significant feature of the situation is that a new company is to operate in the new field with a type of car specially adapted to the service and differing considerably from the Pullman cars in use on the steam roads. The advent of the electric interurban lines means the building up of many new industries outside of the steam road field of which this is only one. The history of railroading by steam is being repeated in the consolidations and constant improvements and betterments of the electric roads, and it may be that the electric trunk line will be a reality instead of a dream.

Although it is impossible to get authentic reports of an accident such as that on the Paris Metropolitan until some time after the event, it seems evident that the loss of life was due entirely, or almost entirely, to suffocation. Early reports of passengers burned by the third rail seem discredited by the fact that the bodies now being recovered do not show burns. It is probable, moreover, that the accident would have caused a short circuit and turned the current off, as it were, automatically. It seems very evident that most of the harm was done by the third train, which became involved in the accident in a manner not yet explained. According to the press reports this train was on the same track with the other; that is to say, a rear end collision took place. Whether this was the case or whether the third train was going in the opposite direction on the other track is not known at the present time, but the latter supposition seems more believable. If the motorman, finding no signal against him, tried to run through, his train might have been stopped by the fact that the current was short-circuited, and it is probable that its momentum would have carried it into the midst of the fire; or, the motorman may have been overcome by the smoke and gases so as to lose his hold on the controller handle, in which case it would snap back and cut the current from the motor. In any case, it seems evident that the great loss of life attending the accident was due to the fact that the passengers were confined in a tunnel and that a similar occurrence in the open air would have been far less serious. The people of New York, Boston and other cities have a vital interest in the accident because of the possibility of like calamities in subways, and the question occurring to everyone has been, what, if anything, is there in our systems to prevent the occurrence of a similar event with the attendant loss of life? An officer of the subway is quoted in the daily press as saying that the superior ventilation of the subway in New York is among the greatest safeguards against smoke suffocation; yet, no provision is made for changing the air in the tunnel, except by means of manholes at the top. In view of the fact that carbonic acid gas is heavier than air and will be constantly sinking to the bottom of the excavation, the action of vents at the top is likely to be comparatively slight. The movement of the trains keeps the air, good and bad, in circulation to a certain extent, but the very fact that the New York and Boston subways are roomy, in comparison with the Metropolitan of Paris, will tend to allow the bad air to remain in the bottom of the tunnel instead of being forced out ahead of moving trains. The fireproofing of the American cars is doubtless a great safeguard, yet it is evident that they are not perfectly fireproofed, or anything like it. Smoke suffocation is the danger which will have to be constantly faced and can only be met by care along all lines of construction and operation.

Warning of the danger from fires in electrically operated subways was given in this column more than a year and a half ago, when there was general unreasonable criticism of the New York Central's operation of its city tunnel by steam. Mr. Westinghouse pointed it out, but the *Railroad Gazette* stood alone then and afterward among technical journals in making plain the new danger. The following quotation from this editorial column in January, 1902, was prophetic:

"From all this it does not follow that it is desirable that people should cease to use electricity for traction; on the contrary, there is not the slightest probability that there will be any interruption of the extension of this use of electricity. But what we want particularly to make folks think about now is the importance of taking every possible precaution against the burning of electric trains and cars. We can conceive of nothing more horrible than a train on fire in a tunnel; but a train on fire on an elevated railroad would be almost as bad. It would seem to follow that anybody equipping a tunnel or elevated road for electric trains should take every precaution known to the present state of the art to guard against fire."

Locomotive Tests at St. Louis in 1904.

The locomotive testing plant of the Pennsylvania Railroad, to be installed at the St. Louis Exposition in 1904, promises to be of unusual interest to those concerned with the design and economical operation of locomotives. The plant is to be built along the most approved lines and every facility will be provided for studying the performance of steam and electric locomotives. The general design will be similar to the locomotive testing plant at Purdue University. The drivers of the locomotive will rest upon supporting wheels carried by shafts running in fixed bearings—the supporting wheels turning in the opposite direction to the drivers. On the shafts of the supporting wheels will be mounted Alden hydraulic brakes by means of which the load may be applied. The drawbar pull will be measured by a fixed dynamometer connected to the drawbar of the engine and will have a capacity of 80,000 lbs. When it is considered that the maximum drawbar pull of the most powerful locomotive in the world* is about 70,000 lbs. it will be seen that the plant is built for the possible requirements of the future. In other words, it will be possible to test a locomotive having approximately 320,000 lbs. weight on drivers.

The tests will be made on a high scientific plane, and the Pennsylvania showed much wisdom in placing the exhibit in charge of an experienced motive power officer and in asking the co-operation of the Master Mechanics' Association and the American Society of Mechanical Engineers. The Master Mechanics have selected F. H. Clark, Superintendent of Motive Power of the C. B. & Q.; C. H. Quereau, Superintendent of Shops of the New York Central, and H. H. Vaughan, Assistant Superintendent of Motive Power of the Lake Shore. The Mechanical Engineers selected Prof. W. F. M. Goss of Purdue University; E. M. Herr, General Manager of the Westinghouse Air Brake Company, and J. E. Sague, Mechanical Engineer of the American Locomotive Company. These two committees met and elected Prof. Goss permanent chairman and H. H. Vaughan secretary of a joint committee to confer with Mr. F. D. Casanave, representing the Pennsylvania. Prof. Goss is at present preparing plans for the conduct of the tests which will be submitted to builders and others desiring to be represented. Mr. Casanave is in Europe, and it is hoped that several foreign roads will send locomotives for testing. It is not the intention to test many engines, but rather to make each test as complete as possible and secure data which will be of value in future designs.

Adverse criticism has often been directed against the results of tests made on stationary plants. It is true that some road conditions (such as the effect of air currents, etc.) cannot be duplicated. On the other hand, it is practically impossible to maintain constant conditions in road tests and unless it is possible to keep all conditions constant during a test the comparisons have little value. For instance, if it be desired to study the effect of a feed water heater on the economy of a locomotive. In a road test an injector may fail to work and enough heat be lost in the overflow to more than offset any gain from the heater. On a stationary plant if an accident of this sort occurred, the overflow from the injector would be caught and carefully weighed, and the temperature taken, and from this data a correction would be applied so as to not affect the reliability of the ultimate comparison. In a stationary plant, an observer with one hand on the valve controlling the water supply to the brakes and his eye on the speed recorder, can keep the speed variations within small limits, while in a road test the speed depends largely upon conditions not under the control of the engineman.

For many years the Master Mechanics' Association has had in view the building of a plant of this kind, and within late years the necessity for data to be used in locomotive design has been particularly urgent. As has been frequently noted in these columns, the conditions of present day railroading have made necessary the use of big engines. This demand has been met by the builders, but in many cases the big engine has failed in service due to defects in design. Ratios which did well for small engines have been found incorrect when applied to the design of very heavy power.

These tests will no doubt bear the same relation to the St. Louis Exposition that the International boiler tests bear to the Centennial Exposition held in 1876. They will also endure as an intellectual monument to the enterprise and scientific spirit of the Pennsylvania Railroad Company.

*Geared locomotive built for the Rock Island by the Lima Locomotive Works in 1902. This engine weighs 291,000 lbs.—all of which is on the 10 drivers.

Deep Sea Trade in American Ships.

The New York Board of Trade and Transportation, of which Oscar S. Straus is President, is distributing resolutions adopted last May pursuant to which a committee on the American Merchant Marine was appointed. The object of the board through this committee is to secure the freest and widest possible immediate discussion of methods for the restoration of the merchant marine of the United States in the foreign trade and a "brief statement of facts" is presented showing that the registered tonnage for over-sea trade is now 873,000 tons with our population of 80 millions as against 981,000 tons in 1810, when the United States had seven million inhabitants. This is the first of the facts stated; the rest of the pamphlet deals with the varying percentages of commerce as carried in American and in foreign bottoms, and with the amounts paid to foreign vessels by the United States for conveying freight and passengers, the sum now reaching upwards of $100,000,000 each year. The committee states that its purpose is to start a free discussion and urges the friends of free ships, of subsidies, discriminating duties and every other policy that has been suggested to present their views and arguments, holding that the system which shall best stand the test of free debate is the system most worthy of adoption.

When attempts to re-establish an American deep-sea fleet are viewed from a purely economic standpoint the item of cost of service rendered becomes formidable. The wages paid to the men who build ships and the men who navigate them are far higher in the United States than in any other country. Figures are frequently printed comparing the pay rolls of the German express steamers with those of the American line, showing that a tremendous difference exists in the sums which must be paid to secure seafaring labor in this country and in Germany. In a recent report of the Commissioner of Navigation, the pay roll of the American liner, *St. Louis*, is compared with that of the *Oceanic* (British), and with the *Kaiser Wilhelm der Grosse*. The table is carried out at considerable length, giving a list of the officers and crew on each ship with their pay per month, and shows that the American vessel employs 380 men at a cost of $11,306 per month. The British vessel employs 427 men at a cost of $9,891 per month, and the German vessel employs 500 men at a cost of $7,715 per month. This works out to an average of approximately $15.43 for the monthly pay of each man on the German ship as against $29.75 for each man on the American ship. That similar discrepancies exist in the cost of building vessels in the United States and abroad is well known. In 1901, Mr. B. N. Baker, then President of the Atlantic Transport line, wrote to the Commissioner of Navigation that his company was having two ships built by Harland & Wolff, at Belfast, and two by the New York Shipbuilding Company at Camden. The cost of the British ships was to be approximately $1,419,120 each. The cost of the American ships, identical in size and speed, was to be approximately $1,846,800 each. Mr. Baker also said that the New York Shipbuilding Company was working on two smaller vessels for the Atlantic Transport line which were to cost $729,000 each, and that the Maryland Steel Company, at Sparrow's Point, was building two ships of the same size at the same cost. The Atlantic Transport line had two other ships, identical in every detail with these smaller vessels, delivered during the year by Harland & Wolff at an average cost of $510,300 each.

The inevitable conclusion presents itself that any kind of legislation to enforce deep sea trade in American bottoms is a species of class legislation, directed either at the shipbuilder or at the ship owner, but conferring no service on the shipper. So long as the United States pays the highest wages of any country in the world, it will be to the advantage of merchants to send their products abroad in foreign ships, in accordance with the well-known axiom that trade seeks the line of least resistance. The argument as to the enormous sums annually paid to foreign vessels loses much of its effectiveness when it is realized that no inconsiderable portion of the foreign tonnage is owned wholly or in part in this country. It is hard to see any economic way in which an American deep-sea fleet could be established except by permitting the American flag to go with ownership instead of with construction, and the actual effect which would be accomplished by this would be of slight consequence except from a sentimental point of view. The Norwegian tramp steamer fruiting for an American concern is a good deal better investment than an American mail steamer, under present wage conditions.

TRADE CATALOGUES.

Pratt & Whitney Company has issued a 6 x 9 booklet on their bench lathe, 10-in. tool makers' lathe, 13-in. engine lathe, and 14-in. gibbed carriage engine lathe. The book contains 67 pages and is illustrated with half-tone plates. The 7 x 32-in. bench lathe is described in detail and illustrations are given of more than 30 of the various attachments which may be furnished with the lathe, giving an idea of the great diversity of work for which this machine is adapted. The 10-in. tool makers' lathe is also carefully described, and illustrations are given showing the application of the collets and split step chucks to the spindle. There are two views of the 14-in. lathe, one showing the standard lathe, the other the lathe with pan bed. A number of important attachments for this lathe are illustrated and described. While these lathes perhaps are not applicable to rough shop use, anyone who cares for good machines or who has to do accurate work will appreciate them.

Circular T of the Industrial Works, Bay City, Mich., is divided into six sections devoted to steam railroad wrecking and construction cranes, hand-power railroad cranes, freight station pillar and transfer cranes, locomotives, cranes, rail-sawing machinery, and transfer tables respectively. It is printed on heavy enamel paper and illustrated with excellent half-tone engravings from photographs.

NEW PUBLICATIONS.

The Alternate Current Transformer. By F. G. Baum. New York: McGraw Publishing Co., 1903. Price $1.50.

This little book, of about 190 pages, is intended to give the student a clear understanding of the principles of the design and operation of alternating current transformers. The author presupposes a knowledge of the theory of alternating currents and carries out the demonstration of the transformer theory from the beginning of the book. The chapters on testing and design are particularly good. There are numerous diagrams and illustrations of different types of transformers scattered through the text and a good index is added.

Notes on High-Speed Tool Steels.*

By HENRY H. SUPLEE, *of New York.*

The following notes represent officially verified data as to the use of high-speed tool steels in the works of the Union Pacific Railroad at Omaha, Neb., and as such are offered as a brief contribution to the subject. As is now well-known, these steels are similar in constitution to the Mushet air-hardening steel, the principal difference being that a much higher temperature is used in the tempering process. The steels contain both chromium and tungsten in varying proportions, as well as molybdenum. The method of treatment consists in heating the tool up to about 2,000 deg. Fahr., then cooling rapidly down to about 1,700 deg. Fahr. in a lead bath, and then slowly in air or lime.

These steels, of which the Taylor-White is the best-known and earliest example, are able to maintain a cutting edge even when operated at speeds producing a red heat; and, in fact, unless such speeds and temperatures are maintained, they do not give satisfactory results. These tools should be used only for roughing purposes, and the great economy resulting from their use appears when it is found that the forgings can be made with less care as to size, the roughing down to finishing dimension being made more rapidly and economically in the machining processes than in forging.

Small chips can be turned from car-wheel tires at lineal speeds of 5 ft. to 8 ft. per minute, the weight of metal removed being about 8 lbs. per hour; this is with ordinary tool steel. Turnings, such as the turnings from a locomotive tire, are made with high-speed steel at a speed of 24 ft. per min., removing 100 lbs. to 120 lbs. per hour; while heavy chips are taken at 18 ft. per minute, removing 450 lbs. per hour. This latter cut was too heavy for the powering of the lathe, however, and the rate could be maintained for only a short time, but the tool showed no signs of distress.

The accompanying tabulated data gives further interesting information from the Union Pacific shops at Omaha, for which the author is indebted to Mr. R. Emerson, secretary of the Union Pacific Railroad Board of Tests, the work being done on a wheel lathe, a planer, and two boring mills.

Test No. 1. Pond lathe machining soft cast iron piston valve bushing. Speed of cut 74 ft. per min.; depth of cut, ½ in.; feed, $^{3}/_{32}$ in.

Test No. 2. Pond lathe machining No. 1 scrap iron 4 in. piston rod. Speed of cut, 18 ft. per min.; depth of cut, ¾ in.; feed, $^{1}/_{16}$ in.

Test No. 3. Pond lathe machining No. 1 scrap iron crankpin. Speed of cut, 26 ft. per min.; depth of cut, ½ in.; feed, ⅛ in.

Test No. 4. Niles vertical boring mill machining steel locomotive driving tire. Speed of cut, 40 ft. per min.; depth of roughing cut, ⅛ in.; feed, ⅛ in.

Test No. 5. Bullard vertical boring mill machining cast iron piston head. Speed of cut, 20 ft. per min.; depth of cut, $^{13}/_{32}$ in.; feed, ⅛ in.

Test No. 6. Bement-Miles horizontal cylinder boring mill machining very hard cast iron 19 in. locomotive cylinder. Speed of cut, 18 ft. per min.; depth of cut, ⅜ in.; feed, ⅛ in.

Test No. 7. Pond driving wheel tire lathe turning down hardened driving tire. Speed of cut, 24 ft. per min.; depth of cut, ⅜ in.; feed, $^{3}/_{32}$ in.; weight of metal removed per hour, 90 lbs.

Test No. 8. Pond planer machining No. 1 scrap iron side rod. Speed of cut, 18 ft. per min.; depth of cut, $^{9}/_{16}$ in.; feed, ¼ in.; weight of metal removed per hour, 247 lbs.

All of these tests were made with Novo tool steel, forged at high lemon color, cooled slowly in air, reheated to white, almost running heat, then cooled in steady air blast or in oil, the latter giving the best results.

*Paper read before the Institution of Mechanical Engineers at Leeds, July 28, 1903.

The Casting of Pipeless Ingots by the Sauveur Overflow Method.*

BY ALBERT SAUVEUR AND JASPER WHITING.

The formation of a cavity technically called a "pipe" in the upper part of steel ingots, under the ordinary method of casting, is well known. If a "piped" ingot be cut in two longitudinally, this defect will appear as shown in Fig. 1.

The great advantage which would result from being able to cast pipeless ingots is appreciated both by producers and consumers. In medium high and in high carbon steel the pipe occupies from 20 to 40 per cent. of the length of the ingot. In the manufacture of armor plates and of some expensive forgings as much as 40 per cent. of the ingot is discarded and only metal free from pipe converted into finished product. In the manufacture of other implements, however, a sufficient amount of metal to insure absolute freedom from pipe is very seldom rejected. Hence the danger of turning out defective material. A very large proportion of the failures of steel implements of all kinds in the process of manufacture, in the testing room or when in use, is due to the presence within them of this defect. The production of pipeless ingots, therefore, would not only do away with the rejection of a large amount of metal, a most important item, but it would also greatly reduce the production of defective implements.

Fig. 1.

Fig. 2.

Fig. 4

After molten steel has been cast into an iron mold, the metal in contact with the bottom and the sides begins first to solidify. After a relatively short while the top of the ingot, which is exposed to the cooling action of the air, also becomes solid and the ingot now consists of a rigid metallic shell holding a mass of molten steel as shown in Fig. 2. As the cooling proceeds this solid shell increases in thickness, but since steel undergoes a considerable contraction in passing from the liquid to the solid state, the mass of metal which when liquid was sufficient to fill the space within the solid shell, will, after it has in turn solidified, be unable to fill it and a cavity must necessarily be formed in the upper part of the ingot. The formation of the pipe is due to the fact that the top of the ingot solidifies while a considerable amount of metal below it is still liquid. Once the top has become rigid the contraction of the liquid interior in passing to the solid condition must necessarily result in the formation of a cavity or pipe. Retarding the solidification of the top should, therefore, decrease the size of the pipe and if it were possible, in a practical way, to maintain the top liquid to the very last, that is, until all metal below it has solidified, the formation of the pipe would be altogether prevented. Efforts have been made in this direction, such as covering the top of the ingot immediately after casting with fuel or with molten slag, or in preheating the top of the mold, but all such attempts have resulted only in a slight decrease in the dimension of the pipe and were accompanied by practical objections which more than offset the small gain effected.

The aim of the overflow method is to maintain the top of each ingot liquid until all metal below has solidified and to do so without in any way interfering with the conduct of the mill operations or adding to their cost. The method consists in so connecting a number of molds that the molten metal can overflow from one mold into the next, while pouring is continued in the same mold until any desired number of molds beyond have been filled.

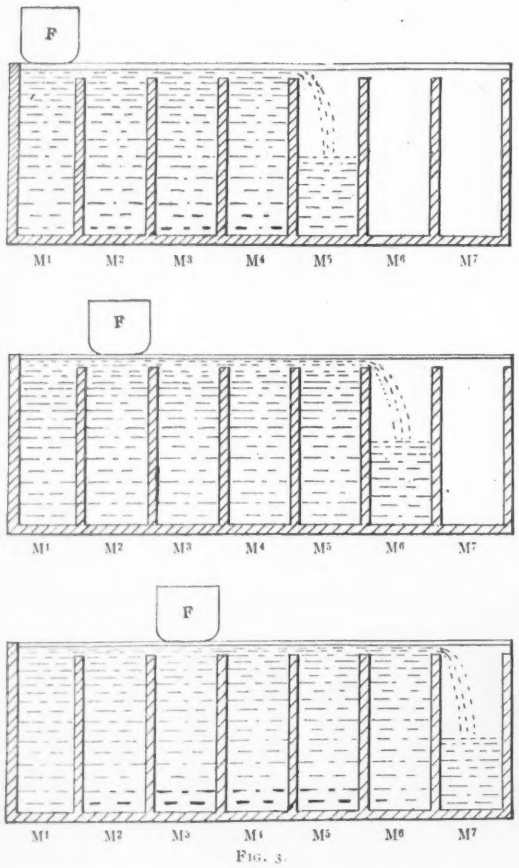


Fig. 3.

In Fig. 3 is shown a diagram representing in elevation a number of molds so connected that after one mold has been filled, if the supply of metal be continued into it, the excess of metal will overflow into the next which will in turn be filled. After mold No. 1 has been filled, the metal will overflow into mold No. 2, and when it has been filled it will overflow into mold No. 3, and so on until six molds have been filled. By this method a flow of molten metal running over the tops of the solidifying ingots is maintained, and the solidification of the tops retarded. This results in a reduction of the pipe, and, if sufficient molten metal be passed over the tops, in the complete obliteration of this defect. The molten metal flowing over the tops of the ingots acts as a sinking head, feeding the pipe, and therefore preventing its formation.

The segregation of impure metal in the upper part of steel ingots, the piped portion, is due to the fact that the impurities present in the metal, especially the phosphides, sulphides and carbides, are more fusible than the metal itself, and have therefore a tendency to collect in the portion of the ingot remaining molten longest. In the overflow method these impurities naturally rise to the very top of the ingot and would then be carried away by the flow of molten metal to be discharged into the next empty mold. Here, however, they are diluted so largely by the metal from the crucible or ladle as to have but a very slight effect upon the average composition of the ingot.

Numerous experiments were conducted with crucible steel ingots in order to ascertain the practical value of the overflow method. The results obtained in casting six ingots, after the manner just described, are shown in Fig. 4, which is the reproduction of a photograph of the broken tops of these ingots. These ingots measured 3½ x 5½ x 22½ in., and weighed 100 lbs. The steel cast contained from 0.9 to 1.00 per cent. carbon and was produced in a regenerative crucible furnace.

Ingots of this size and grade cast in the usual manner had a pipe extending on an average about 8 in. downwards. Ingots cast by the overflow method, No. 1 and No. 2 are absolutely free from pipe. They are solid masses of metal to the very top. The metal which was cast upon these ingots had caused their top to remain liquid until the metal below it had become solidified, preventing the formation of a pipe. No. 3 and No. 4 ingots show a small cavity measuring about 1 in., while No. 5 ingot has a 4-in. pipe. No. 6, which is not shown here, was not, of course, materially improved. These experiments were repeated a number of times and the results obtained were in every case very similar.

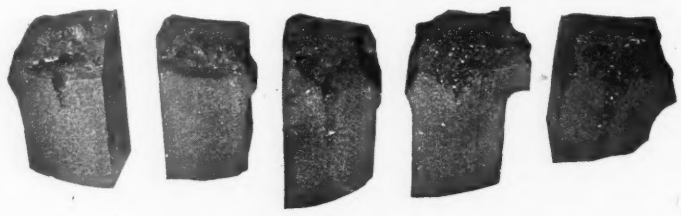


Fig. 5.

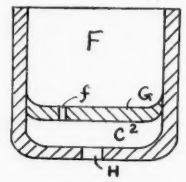


Fig. 7

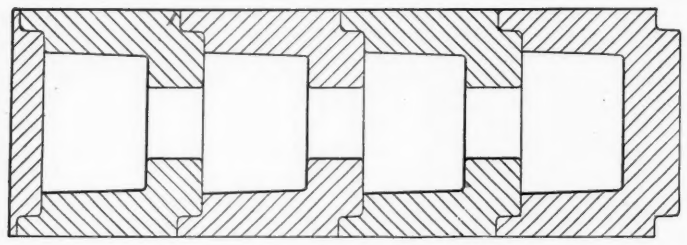
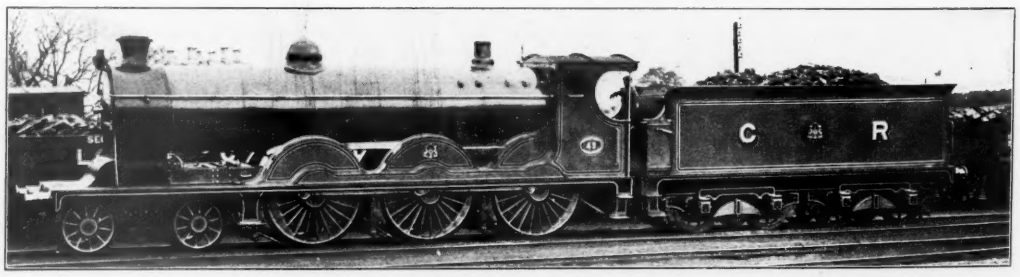


Fig. 6.

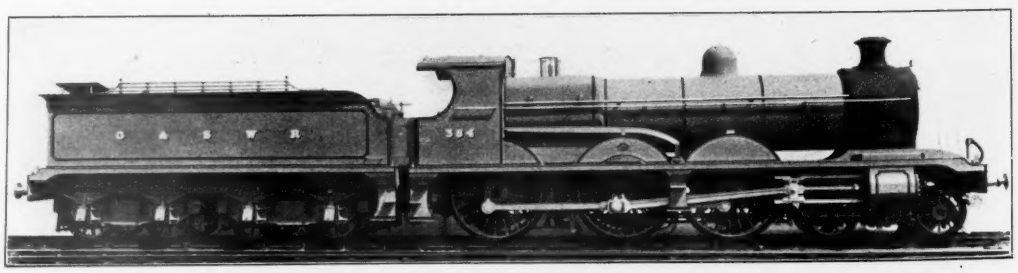
From the appearance of No. 5 ingot we infer that the passing over the top of an ingot of sufficient metal to fill one more mold by causing it to overflow into it will reduce the length of the pipe some 50 per cent., while the passage over the molten top of an ingot of enough metal to fill four more molds will result in the complete elimination of that cavity.

In Fig. 5 are shown a number of pipeless or nearly pipeless ingots obtained by the overflow method.

In casting six ingots in the manner just described, while the first two ingots will be pipeless, the remaining ingots will have small pipes of increasing length. The overflow method may, however, be conducted in a more continuous manner, so that enough metal will flow over the tops of all the ingots to make them pipeless, namely, in the present case, enough metal to fill four or five additional molds. If for instance, returning to Fig. 3, after having filled six molds by pouring in No. 1, the pouring be shifted to No. 2 and enough metal be cast to fill mold No. 7, and then the pouring be shifted to mold No. 3 and enough metal cast to fill No. 8 and so on, it is evident that the necessary amount of metal will have flowed over the top of each ingot to prevent the formation of a pipe.



Caledonian Railway 4-6-0 Express Locomotive.



Glasgow & South-Western 4-6-0 Locomotive.

*A paper read at the sixth annual meeting of the American Society for Testing Materials, July, 1903.

It is quite obvious that the amount of metal which must flow over the top of an ingot in order to make it pipeless will vary with the size of the ingot, the temperature of the metal, the rate of cooling, the composition of the steel, etc. In each mill the most desirable manner of conducting the overflow method will have to be ascertained by a few preliminary experiments.

A suitable connection between molds had to be devised, and this important point was solved with complete success by using the molds illustrated in Fig. 6. They are three-sided molds, each mold moreover being in two sections for convenience in stripping. When these molds are properly assembled and fastened together, each two adjacent molds have a common wall between them at the upper part of which a groove is provided for the overflowing of the metal from one mold into the next. These molds have given very good satisfaction. They are, if anything, less expensive than the ordinary style of molds used in crucible steel manufacture.

It was found undesirable to teem directly into the molds, as in doing so the metal is agitated to too great a depth during the teeming to allow of the quiet, undisturbed, cooling desired. To avoid this disturbance, caused by the fall of the metal into the mold, a receptacle was used shown in Fig. 7, which consists of a crucible-like appliance provided with a false bottom. Each bottom is provided with one hole of suitable size. This crucible rests upon the mold into which it is desired to teem and the steel is poured into it in the usual manner. The metal flows into the lower chamber and from it into the mold. The relative sizes of the holes are so regulated that the lower chamber is being constantly drained. In this way the fall of the metal is broken and the steel in falling into the molds produces very little agitation of the molten top.

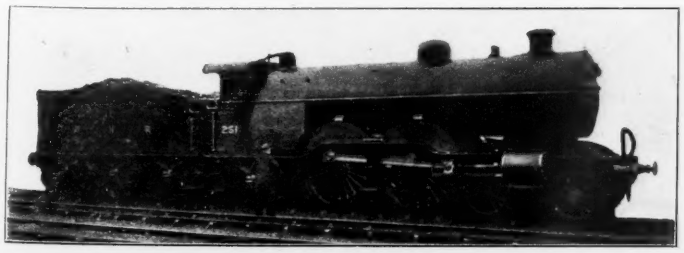
The overflow method is now being installed at the steel works of the Simonds Manufacturing Company, of Chicago, where the experiments were conducted. It was quite natural to first apply the method to the casting of crucible steel ingots, but experiments are now under way to ascertain its value in casting Bessemer and open-hearth steel ingots.

Some Recent English Locomotives.

The accompanying illustrations are of a few of the latest productions of English locomotive builders. The three engines shown are all intended for heavy fast passenger service. The Caledonian engine is of the 4-6-0 type with cylinders 21 in. x 26 in. inside connected to the leading drivers. These engines have 2,800 sq. ft. of heating surface, 78 in. driving wheels, and carry 200 lbs. steam pressure. On a recent test one of them ran 73.5 miles in 76 minutes, part of the way up a long 1 per cent. grade, hauling 400 long tons.

The Great Northern engine of the Atlantic, or 4-4-2 type, has 84 in. driving wheels, outside connected, and a wide fire-box, said to be the only wide fire-box in England. The 4-6-0 type for the Glasgow & South Western is also outside connected and has 78 in. driving wheels. The boiler has 1,800 sq. ft. of heating surface and carries steam at 180 lbs. These engines are used on the heavy express trains in the Anglo-Scottish traffic by the Midland.

The car shown in the engraving is one of the new motor cars recently introduced on the Central London (Underground) to do away with the excessive vibration caused by the heavy electric locomotives heretofore used.



Great Northern 4-4-2 Atlantic Type Locomotive.

Electric Motor Carriage for The Central London (Underground).

Some New Products of the Chicago Pneumatic Tool Company.

The plug drill (Fig. 1) is a combination of a standard No. 1 Boyer hammer and a drill with a rotating device which automatically turns the drill while the hammer is delivering the blows. The drill weighs 18 lbs. complete and is said to use 20 cu. ft. of free air a minute at 80 lbs. pressure, and will drill a ⅝ in. hole 3 in. deep in 20 seconds. The drill works equally well in all kinds of stone by changing the cutting edge to suit the character of the material. The tool has been used with success in all classes of plug and feather work and is now in use in a number of large quarries and cutting sheds.

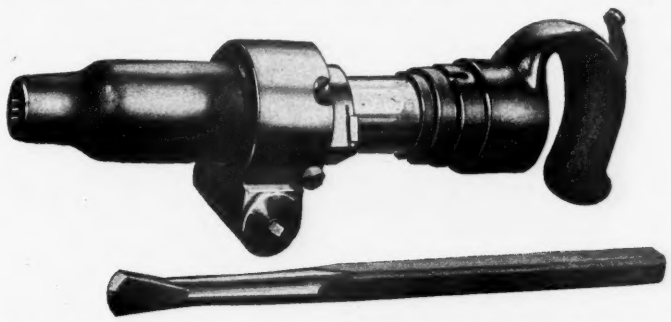


Fig. 1.—Plug Drill Made by the Chicago Pneumatic Tool Company.

Fig. 2.—Sand Rammer Made by the Chicago Pneumatic Tool Company.

The sand rammer (Fig. 2) has been designed so that the operator can stand in an erect position while using it. The piston is $1^1/_{16}$ in. in diameter, has a stroke of 7 in., and delivers 500 blows a minute. It uses about 30 cu. ft. of free air a minute at 80 lbs. pressure. The weight is 17 lbs. complete.

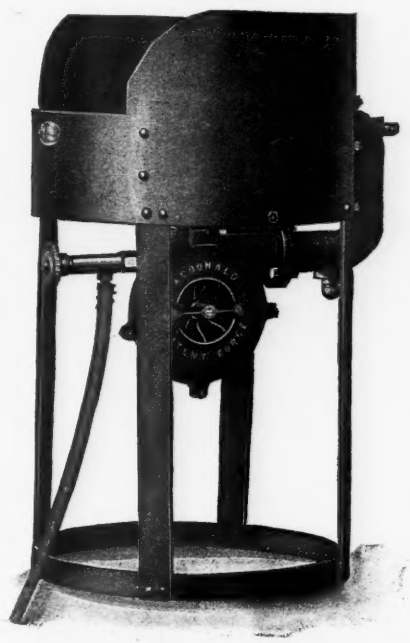


Fig. 3.—Air Forge Made by the Chicago Pneumatic Tool Company.

The air forge (Fig. 3) differs from other forges made by the company in that coal or coke may be used. A jet of air passes through a $^1/_{16}$-in. needle valve and impinges against buckets on a bucket wheel fastened to the shaft of the fan. The fan is open to the outer air and a blast of air is continuously blown through the tuyere. The supply pressure is from 60 lbs to 100 lbs., and the fan uses from 5 to 7 cu. ft. of free air a minute. The fan revolves at 4,000 r.p.m. with a supply pressure of 80 lbs. The forge is 3 ft. high over all, and the pan or fire-box is 20 in. in diameter and 10 in. deep. The forge weighs 114 lbs. complete.

TECHNICAL.

Manufacturing and Business.

H. Stewart, General Foreman of Doud Stock Car Company, has resigned and has been succeeded by Jas. Buker, formerly with the Consolidated Cattle Car Company.

An office of the Hennebique system of armored concrete construction has been opened in the Monon Building, Chicago, with L. J. Mensch, Civil and Consulting Engineer and Contractor, in charge.

The Perfect Replacer Company has been incorporated under the laws of New York State, with a capital of $50,000, by F. William Snow, 29 Broadway, New York city; C. F. Heitzman and A. J. Hall. The company is formed to make the Perfect pressed steel car and locomotive replacer.

Charles M. Schwab resigned as President of the United States Steel Corporation on Aug. 4, and William E. Corey was appointed to be his successor. Mr. Schwab remains a director and a member of the executive committee. For the past few weeks Mr. Corey has been acting as Assistant to the President, with full powers.

Iron and Steel.

The work commenced May 20 for the Cambria Steel Co., Johnstown, Pa., to remodel the No. 6 furnace has been completed two weeks earlier than the contract called for. The new stack is 22 ft. x 85 ft., and has a capacity of 400 tons per day.

Wood Preservation in Denmark.

In the Danish Budget of the present year a vote has been granted to the Association of Royal Danish Engineers, so that in the Government Testing Laboratory a series of investigations may be made of different wood preservatives, in order to determine their relative power to protect wood against decay and fungus. The investigation is to be made by treating a great number of posts with the different preservatives, and then burying them where for a considerable number of years the effect of the preservatives may be controlled. The committee appointed by the Association of Royal Danish Engineers to conduct the investigations request manufacturers and dealers to communicate with Mr. Irminger, manager of the Eastern Gas Works, Copenhagen, as to preservatives they wish tested.—*The Engineer.*

Interlocking.

The Pneumatic Signal Co. has contracts for the installation of 50 interlocking plants. Two of them are of especial interest, inasmuch as they are the first considerable installations by this company of their all-electric interlocking system. The one at Park Junction, Baltimore & Ohio, has 25 levers; the other at Texarkana has 46 levers.

The 13,000-Ton Battleships.

On account of the criticisms of the report of the Naval Board which recommended that the 13,000-ton battleships authorized by Congress last session be given great battery power and heavy armor but comparatively low speed, the Secretary of the Navy has decided to ask individual officers of the Navy for opinions as to whether these ships should have less speed and coal capacity than the 16,000-ton ships, or be given the same speed and coal capacity, but less armor and lighter guns.

Rails Made in Mexico.

One of the largest industrial concerns in Mexico, the Monterey Iron & Steel Company, was organized in May, 1900, with a capital of $10,000,000. At its large steel plant located at Monterey the making of structural steel was begun two months ago, and the first steel rails ever rolled in Mexico were recently turned out. Two thousand men are employed, many of them skilled workmen from the United States and Germany. At Golondrina, in this State, in the iron mines, and in the coal mines in the State of Coahuila, 5,000 more men are employed. The iron mines of the company are considered the richest in Mexico. The equipment of the plant is such that 80-lb. steel rails can be made and large orders are on hand for several of the Mexican railroads for large quantities of rails. The company expects to develop a large trade in Central and South America.

River and Harbor Works at Washington.

The annual report of Col. Allen, Corps of Engineers, in charge of river and harbor works at Washington, D. C., says that since the work of reclaiming the Potomac flats was begun in 1882, $2,353,712 has been expended on this work and the dredging of the Potomac River channels to a width of 400 ft. and a depth of 20 ft. at low tide. The area of land reclaimed is 739 acres, including the tidal reservoir, this area being known as Potomac Park and consisting of 621 acres of land and 118 acres of inclosed water area around which 35,289 linear ft. of sea wall has been built. Of the total amount spent, all but $399,000 was appropriated in the first 10 years of the work, the other $399,000 having been appropriated in the last 11 years. To remove deposits due to freshets, and for the final dredging of the tidal reservoir and the construction of the reservoir inlet gates and for maintenance, the report says that $400,000 can be profitably spent during the fiscal year ending June 30, 1905, and the appropriation of that amount in one sum is recommended.

The work of dredging the Anacostia River, or eastern branch of the Potomac, under a contract let last winter

to the Sanford & Brooks Company, of Baltimore, has been under way since Feb. 6 last. Since that date 22,693 cu. yds. of material has been dredged from the trench along the river front. To protect the embankment and later serve as foundation for a sea wall, 8,767 cu. ft. of rip-rap stone has been laid along 1,820 ft. The acquisition of some land required for depositing dredged material below the Navy Yard bridge is recommended and the rapid reclamation of the flats until they are above ordinary tides is urged. For the fiscal year ending June 30, 1905, an appropriation of $300,000 is asked for dredging and disposing of dredged material on this project.

The Effect of Electric Competition.

J. B. Cockrum, attorney for the Lake Erie & Western, has asked the Indiana State Tax Board for a $500 per mile reduction on the ground that the company's lines have been paralleled to a great extent and that its business has been seriously injured by the electric roads. He says still more interurban lines are to be opened to invade the company's territory, and for these reasons the tax assessment should be reduced.—*Western Electrician.*

THE SCRAP HEAP.

Notes.

The Central New England is reported to have made a joint freight tariff with the Boston & Albany and the Boston & Maine. Under the new traffic agreement the Central New England will receive a long haul on freight shipped from or consigned to points in Northern and Eastern New England instead of the short haul from Hopewell to Poughkeepsie, as at present.

Press reports from the West indicate that no immediate change is expected in the eight dollar rate from St. Paul and Minneapolis to Chicago. The competing lines claim that they can make money at the eight-dollar rate with the present heavy travel. The Elkins law makes it impossible for the roads to give buyers transportation on their trips to the East, but does not interfere with a low open rate.

An active canvass is being made in New York against the proposition to build an additional subway line down Broadway from 42nd street to Union Square in such a way that the street will be made an "open ditch." The adjacent property owners are much aroused and believe that their business would be hurt enormously if Broadway were thus closed. The property owners demand that the subway be built entirely by tunneling and not by ditching.

Secretary Cortelyou has transferred to the Census Bureau the statistical work of the Bureau of Immigration. The reports of the immigration officials at the various ports will pass from the Immigration Bureau, as usual, but the mass of statistical work involved will be done by the census department. The division is a natural one which can properly be extended to the statistical branch of other bureaus, leaving them more free to perform the work for which they are especially intended and equipped.

According to press reports, Postmaster General Payne will make the experiment of employing baggage men to take charge of and to deliver open newspaper mail on trains not provided with mail clerks. The plan provides for the enrollment of the baggage masters as employees of the post office department, and they will be paid for their services. Papers are to be delivered from the car door to points where they are addressed along the line, so that they will not go through the local post offices before their delivery to agents.

As the result of a rate war between the Pacific Mail Steamship Company and the Chinese Commercial Company, newly organized, the steerage rate from Los Angeles to Hong Kong has been cut from $85 to $25, including 500 miles of railroad transportation from Los Angeles to San Francisco and 7,000 miles across the Pacific. The trip takes four weeks, during which time passengers are supplied with food by the steamship company. In cost per mile, which comes to about .33 of a cent, the rate for ocean transportation has only been equaled, so far as known, by the steerage rate of $9 from New York to Southampton, which was made some years ago by the American line, but the Southampton steerage passengers were fed for approximately a week only, instead of for four weeks. Cabin rates are not affected by the present cut.

Shut-Down of the Crescent Yard.

The Crescent ship yard, Elizabethport, N. J., has been shut down for a week, beginning August 10, by order of ex-Senator James Smith, receiver. Inventory of stock is the reason given for the shut-down, but some doubt has been expressed whether or not the plant will be opened again promptly.

Fight With Tramps on the Erie.

On August 5, in a fight between the crew of eastbound freight train No. 82 and four tramps on the Erie between Falconer and Kennedy, N. Y., one of the tramps fell between the cars under the train and was killed, and a brakeman was badly stabbed. The man who did the stabbing has not been caught.

Tunnel Collapse in West Virginia.

The Chapline Hill tunnel of the Wheeling Terminal Railroad collapsed for a distance of over 60 ft. on the morning of July 30. The track cleaner at the terminal station was passing through on his way to work at the time, and narrowly escaped with his life. The roof of the tunnel had been partially shored up previous to making repairs.

Train Wrecked While House-Moving.

The *Los Angeles Herald* says that Palmer Brothers, house movers of San Diego, Cal., on July 28 chartered a train on the Pacific Beach & La Jolla Railroad to convey some buildings to the latter place. While rounding a curve a house fell off the car and wrecked the train. The Pacific Beach & La Jolla is presumably not much bothered by narrow cuts and overhead crossings.

Train Wrecked by Dynamite.

Press reports from Montana say that another attempt was made to wreck a Northern Pacific train with dynamite near Boseman on August 4. Dynamite placed on the track with the evident intention of wrecking an eastbound passenger train wrecked a freight instead, the crew escaping with minor injuries. A similar attempt was made at Butte, Mont., on August 2, as reported in the *Railroad Gazette* last week.

Cars Not to Run in Trains.

Corporation Consul Rives made public an opinion August 6 denying the right of the Brooklyn Rapid Transit Company to run three-car trains through the streets of Jamaica. The decision is one of the first of its kind in placing a limit to what can be done by interurban cars in city streets. The opinion was given in response to a request from the Board of Aldermen, and Mr. Rives holds that an ordinance designed to prevent a method of operation of street surface railroads in which heavy cars were run through the streets of the city in trains, would rest upon a reasonable basis.

No Excess Fare in South Carolina.

On July 30 the Supreme Court of South Carolina handed down a decision in the case of Fulmer vs. The Southern Railway. The plaintiff declined to pay the excess rate demanded by the conductor on a cash fare paid upon the train, and was ejected. He thereupon brought suit against the company on the ground that railroads have no legal right to charge any excess above the regular fare and was defeated in the Court of Common Pleas, but appealed to the Supreme Court of the State, which has reversed the decision of the lower court, holding for the plaintiff. In hearing the case the justices of the Supreme Court had sitting with them the Circuit Court judges.

The Behr Mono-Rail Project Again.

The prospectus of the proposed mono-rail line from Liverpool to Manchester is now before the British public, and investors are invited to apply for portions or the whole of the $10,500,000 stock. The projectors have secured "excellent sites for terminals," and are going to run trains at the rate of 110 miles an hour, on 10 minute headway. The company has full sets of estimates, which have been much examined and approved, and which tend constantly toward lower maintenance and greater speed than the conservative promoters specify. Doubtless there will be found buyers, but the casual observer on this side of the water is permitted to guess at the price which Behr Mono-Rail common or preferred would be likely to command at the present time, in the New York market.

The Harvest Outlook.

The Department of Agriculture has published its August report, giving the indicated harvest for 1903. Taking the report as a basis, the Produce Exchange estimates the crop of winter wheat, now fully harvested, at 410,000,000 bushels as against 411,788,666 bushels in 1902, from 33,107,000 acres of land, as against 28,581,426 harvested in 1902. Spring wheat is estimated at 239,872,000 bushels as against 258,274,342 last year. The acreage is estimated at 17,257,000 as against 17,620,998 in 1902. This gives a total wheat production of 615,399,000 bushels as against 670,063,008 bushels last year, on an acreage increased from 46,202,424 acres to 50,364,000 acres. The total corn crop is estimated at 2,245 million bushels as against 2,523,648,312 last year. The total barley crop is estimated at 114,200,000 as against 134,954,023 last year.

An Idea for Sale.

The Baldwin Locomotive Works have received from a seat of learning, Cambridge, England, a letter offering an idea for sale and, as they have not decided to avail of the opportunity, it is here printed:

"Believing that electricity will revolutionize long distance steam haulage rather than supersede it, my endeavor has been during spare time to try and find a method of attaining that end. I am not an engineer, so-called, but merely an amateur inventor using common sense as guide. Is it not your opinion, as well as my own, that railroad practice will have to be modernized in principle, Marconi-ized in fact, before really quick transit can be expected? My idea doesn't do all that. But it would make that possible if it were in the hands of a firm, with the time, tools, technical knowledge and means to carry out some moderately expensive experiments. It is a feasible to-morrow idea, not a perfect next century one. Is yours one of those firms that try ideas, as such? If I would have explained everything about it, they might have carefully considered it on this side. That appears to me unreasonable with an idea, only; we must speculate sometimes. What is it worth? I want as much as I can get to develop something else. If you think of buying, kindly bear that in mind. I have confidence in it myself and even think it would keep some time longer, if necessary. Still, I don't want to appear unreasonable."

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Iowa Railway Club.

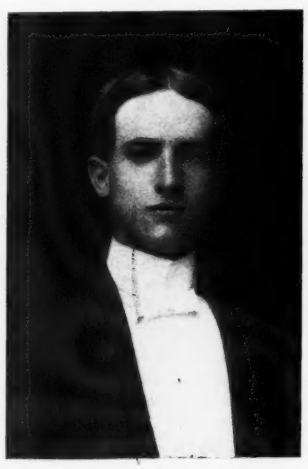
At the June meeting of this club, the proceedings of which have just reached us, the papers presented were: "Should Frogs and Switches Be Blocked?" by G. E. McCaughan, of the Rock Island System, Chicago, Ill., also by J. H. Maher, of the Rock Island System, Des Moines, Iowa; "Economy of Stub Switches in Yards," by J. B. Moll, of the Milwaukee road, Chicago; "Should the Government Own or Control the Railroads?" by E. C. Nettels, Chicago, Milwaukee & St. Paul, Des Moines, Iowa; also by E. Wentworth, Pennsylvania Lines, Davenport, Iowa; "Handling Tickets by Conductors," by W. F. Gould, of the Rock Island.

PERSONAL.

—Mr. James R. Dutton, whose resignation as Purchasing Agent of the Michigan Central has been announced, has been in the service of this company for the past 48 years. He was born at Canton, St. Lawrence County, N. Y., in 1833. In 1856 he went to work for the Chicago & Alton as a brakeman, but soon resigned to go to the Michigan Central, where he passed through various departments until 1891, when he was promoted to the position of Purchasing Agent.

—Mr. Warren Stanford Stone, of Eldon, Iowa, has been elected to fill the unexpired term as Chief of the Brotherhood of Locomotive Engineers, made vacant by the deaths of P. M. Arthur and A. B. Youngson. Mr. Stone was born in Ainsworth, Iowa, in 1860. He has been railroading for 24 years on that portion of the Rock Island system known as the Missouri Division. He has been Chairman of the General Board of Adjustment of that road for a number of years.

—Mr. Dudley F. Chittenden, the new Superintendent of the Carrabelle, Tallahassee & Georgia, was born in Newark, N. J., in 1881. He was educated in the public schools and at the age of 17 entered the School of Technology at Atlanta, Ga., and spent several months in shop work, mechanical drawing and mathematics. For about two years he was in the shops of the Southern Railway as special apprentice at Atlanta. He then went to work for the Southern Express Company as messenger between Fernandina, Fla., and Tallahassee, and between Jacksonville and Pensacola. For a time he was on the Seaboard Air Line and the Louisville & Nashville. He afterward became conductor on the Carrabelle, Tallahassee & Georgia, but in a few weeks was appointed Trainmaster, from which position he has been promoted to be Superintendent at Tallahassee.



—Mr. S. B. Kramer, who has become Master of Transportation for the Grand Trunk at Montreal, was born in Maryland Sept. 25, 1865. His first railroad experience was on the Vandalia in 1882. In 1886 he went to the Union Pacific as a despatcher. In 1893 he resigned to go to the Wabash as Chief Despatcher and later was Master of Transportation. For a time Mr. Kramer was on the Central Vermont. In 1902 he was appointed Chief Despatcher on the Grand Trunk and has been with this company ever since.

—Mr. J. I. Vernon, the new Acting Signal Engineer of the New York, New Haven & Hartford, with jurisdiction over all the lines of this company, is an experienced signal engineer. He was born in England about 50 years ago, and came to the United States about 1883, when he entered the service of the Union Switch & Signal Co., in charge of construction work, and remained with the company for about 10 years. Mr. Vernon was at the time of his new appointment Supervisor of Interlocking (Eastern District) of the New York, New Haven & Hartford at Mansfield, Mass.

—Prof. Eugene Wycliffe Kerr, Junior M. Am. Soc. Mech. Eng., who becomes instructor in Machine Design at Purdue University, Lafayette, Ind., was born in Collin County, Texas, and graduated from the Agricultural and Mechanical College of that State, with the degree of Bachelor of Science, in 1896. He received the degree of Mechanical Engineer from that institution in 1899, and in the summer of '99 took a course in Experimental Engineering at Stevens' Institute of Technology at Hoboken, N. J. The summer of 1902 was spent as a graduate student at the University of Wisconsin, where he gave special attention to the study of fuel calorimetry and to work in applied electricity. He also spent some time as a graduate student at Purdue University, specializing in the department of Railway Mechanical Engineering. Prof. Kerr was appointed to the position he now leaves,

that of Assistant Professor of Mechanical Engineering in the Agricultural and Mechanical College of Texas, in 1896. He is a member of the Texas Academy of Science and also of the Western Railway Club of Chicago. He is the author of a text book entitled "Power and Power Transmission."

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—A. Harrity has been appointed Division Master Mechanic, with headquarters at Raton, N. Mex., succeeding D. A. Sullier.

Atlantic & Birmingham.—The jurisdiction of Alex. Bonnyman, Superintendent, has been extended over the Tifton, Thomasville & Gulf. J. E. Cameron has been appointed Master Mechanic, with headquarters at Waycross, Ga., succeeding G. E. Jones.

Baltimore & Ohio Southwestern.—J. B. Cameron has been appointed Division Engineer, with headquarters at Chillicothe, Ohio.

Central Indiana.—The headquarters of W. S. Parkhurst, Auditor and General Freight and Passenger Agent, have been removed from Muncie, Ind., to Anderson.

Chesapeake & Ohio.—W. T. Smith, Master Mechanic at Richmond, Va., has been transferred to Covington, Ky., succeeding C. H. Terrell, who has been transferred to Huntington, W. Va., to succeed A. F. Stewart, who in turn is transferred to Clifton Forge, Va., succeeding J. R. Gould, who has been transferred to succeed Mr. Smith. W. F. Hite, hitherto Division Freight Agent, has been appointed Assistant General Freight Agent, with headquarters at Richmond, Va., succeeding J. F. Orndorff, resigned.

Chicago & Alton.—W. Daves has been appointed Signal Engineer, with headquarters at Bloomington, Ill., succeeding B. H. Mann, resigned.

Chicago, Rock Island & Pacific.—John F. Stevens has been elected Fourth Vice-President and is succeeded as Chief Engineer by W. L. Darling, hitherto Chief Engineer of the Northern Pacific. Mr. Darling's headquarters will be at Chicago.

Chicago Short Line.—Charles R. Hill, hitherto on the Lake Shore & Michigan Southern, has been appointed Auditor of the C. S. L., succeeding W. W. Pope, deceased. Fred H. Heywood, of Columbus, Ohio, has been made Treasurer.

Denver, Enid & Gulf.—The general offices of this company have been removed from Blackwell, Okla. T., to Enid, Okla. T.

Grand Trunk.—S. B. Kramer has been appointed Master of Transportation, with office at Montreal.

Jacksonville & Southwestern.—The officers of this company are: President, Charles W. Chase; Vice-President, L. W. Chase; Secretary and General Manager, Edward S. Spencer; Treasurer, H. F. Dutton, Jr.; Auditor, M. H. Haughton; General Counsel, E. J. L'Engel, and Master Mechanic, J. J. Whitaker.

Kansas City Southern.—W. A. Moore has been appointed Division Engineer, in charge of all the repair work on the Terminal Division.

Missouri, Kansas & Texas.—E. J. Lampert, Superintendent, with headquarters at Franklin Junction, Mo., has resigned.

Mobile & Ohio.—C. T. Airey, General Agent, with office at Atlanta, Ga., has resigned.

New York, New Haven & Hartford.—J. I. Vernon, hitherto Supervisor of Interlocking, has been appointed Acting Signal Engineer over all the lines, succeeding H. D. Beach, Signal Engineer, resigned.

Northern Pacific.—E. J. Pearson, hitherto Assistant General Superintendent at Livingston, Mont., has been appointed Acting Chief Engineer, with headquarters at St. Paul, Minn., succeeding W. L. Darling, Chief Engineer, resigned, effective Aug. 15. (See Chicago, Rock Island & Pacific.)

North Shore.—O. F. Griffin has been appointed Auditor, with headquarters at San Francisco, Cal., succeeding E. D. Thomas, resigned.

St. Louis Southwestern.—E. J. Nichols, Assistant Engineer, with office at Pine Bluff, Ark., has resigned.

Southern.—W. E. Vest has been appointed Resident Engineer, with office at Charlotte, N. C., succeeding H. L. Coe, Roadmaster, resigned. S. C. Ramsey has been appointed Roadmaster of the Asheville Division, succeeding R. E. Simpson, promoted.

Southern Pacific.—B. A. Worthington has been appointed Assistant to J. Kruttschnitt, Fourth Vice-President, General Manager and Assistant to the President. D. Burkhalter, hitherto Superintendent of the San Joaquin Division, has been appointed Superintendent of the Coast Division, with headquarters at San Francisco, Cal., succeeding Mr. Worthington. C. C. Sroufe has been appointed to succeed Mr. Burkhalter at Bakersfield, Cal., and Mr. Sroufe in turn is succeeded by T. R. Jones as Superintendent of the Tucson Division. Mr. Jones was hitherto Assistant Superintendent of the Sacramento Division.

Suffolk & Carolina.—J. C. Causey, Jr., has been appointed Chief Engineer, with headquarters at Suffolk, Va., succeeding H. P. Beck, resigned.

Tifton, Thomasville & Gulf.—See Atlantic & Birmingham.

Western & Atlantic.—J. A. Baldwin has been appointed Assistant Superintendent, with office at Atlanta, Ga., succeeding C. S. Evans, deceased.

LOCOMOTIVE BUILDING.

The Seaboard Air Line is reported to be figuring on 30 locomotives.

The Richmond, Fredericksburg & Potomac is in the market for 10 locomotives.

The Terminal Railroad Association of St. Louis, as reported in our issue of July 31, has ordered 15 simple six-wheel switching (0-6-0) locomotives from the Manchester Works of the American Locomotive Co. The locomotives will weigh 136,000 lbs.; cylinders, 20 x 26 in.; 51 in. drivers; straight boilers, with a working steam pressure of 180 lbs.; heating surface, 1,914 sq. ft.; 323 charcoal iron National Tube Co.'s tubes, 2 in. in diameter and 10 ft. 5 in. long; fire-box, 108 in. long and 42 in. wide; grate area, 31½ sq. ft.; tank capacity, 5,000 gallons of water and six tons of coal. The special equipment includes: Westinghouse air-brakes, Sterlingworth brake-beams, Tower couplers, Simplex injectors, U. S. piston and valve rod packings, Coale safety valves, Leach sanding devices, Nathan sight-feed lubricators, Scott springs, Crosby steam gages and Midvale driving wheel tires.

The Zanesville & Western has ordered five simple consolidation (2-8-0) locomotives from the Brooks Works of the American Locomotive Co., for December, 1903, delivery. The locomotives will weigh 150,500 lbs., with 130,000 lbs. on the drivers; cylinders, 20 x 26 in.; 54 in. drivers; Belpaire boilers, with a working steam pressure of 180 lbs.; 240 Shelby seamless tubes, 2 in. in diameter and 13 ft. 10 in. long; Otis fire-box, 108 in. long and 41 in. wide; tank capacity, 5,000 gallons of water and 10 tons of coal. The special equipment includes: Keasbey & Mattison boiler lagging, Solid brake-beams, Diamond "S" brake-shoes, Buckeye couplers, Star headlights, Ohio injectors, U. S. piston and valve rod packings, Leach sanding devices, Michigan sight-feed lubricators, Railway Steel Spring Co.'s springs, Crosby steam gages and Standard driving, truck and tender wheel tires.

CAR BUILDING.

The American Car & Foundry Co. has miscellaneous orders for 125 cars.

The Chicago & Eastern Illinois is reported to be in the market for 1,000 cars.

The Pittsburg & Lake Erie has ordered five coaches from the American Car & Foundry Co.

The Cleveland, Cincinnati, Chicago & St. Louis denies being in the market for passenger cars at the present time.

The Mobile, Jackson & Kansas City has ordered 200 flat cars and 50 box cars from the American Car & Foundry Co.

The Baltimore & Ohio has ordered 40 coaches, 15 baggage cars, 15 combination baggage and passenger cars, 10 combination mail and baggage cars and two postal cars from Barney & Smith. The specifications for these cars were given in our issue of July 31.

The Norfolk & Western, as reported in our issue of Aug. 7, is building 500 hopper cars of 1,000 lbs. capacity, at its Roanoke shops. These cars will weigh 38,000 lbs., and will be 30 ft. 9 in. long, 8 ft. 9½ in. wide, inside measurement, and 10 ft. ½ in. high, with wooden and metal frames and metal underframes. Special equipment includes steel axles, steel bolsters, N. & W. metal brake-beams, Westinghouse brakes, tandem draft rigging and Barber trucks.

BRIDGE BUILDING.

BATH, ME.—Action will be taken Sept. 7 to rebuild Bay Bridge, the cost, not including causeway and approaches, to be about $65,000. Address J. R. Worcester, Boston, Mass.

BATTLE CREEK, MICH.—The city contemplates building a bridge on West Main street 108 ft. long x 66 ft. wide, to cost about $17,000.

BIRMINGHAM, ALA.—The Seaboard Air Line, it is reported, will extend the viaducts over 21st and 22nd streets so that they will end near Avenue B instead of Avenue A.

BURNSIDE, CONN.—At a special town meeting the selectmen were authorized to build a bridge over the Hockanum River on Forbes street, at a cost not to exceed $13,000.

CASSELTON, N. DAK.—The county will build and repair a number of bridges.

CINCINNATI, OHIO.—The County Commissioners are considering a bridge near Cleves, over the Miami River. Plans call for a steel structure to cost about $150,000.

COLUMBUS, OHIO.—At a conference held between the County Commissioners and the Pennsylvania, the subject of placing the Leonard avenue viaduct in shape for temporary use was discussed. The Joyce avenue section has been condemned. Plans will be drawn for a new superstructure for the viaduct.

DEPOSIT, N. Y.—Plans are being prepared by the Erie to replace the iron bridge with a new steel structure at this place.

DERBY, CONN.—The bids opened Aug. 4 by the corporation counsel for the steel bridge over Naugatuck River were as follows: For the complete structure, including temporary bridge, the Berlin Construction Co., of Berlin, bid for low-grade, $58,100, high-grade, $73,825, and C. W. Blakeslee & Co., of New Haven, for low-grade, $65,557, and high-grade, $79,672. Other bids for superstructure, substructure and temporary bridge, were: King Bridge Co., Cleveland, Ohio, $33,925, $51,675, $7,500; from Penn Bridge Co., Beaver Falls, Pa., $29,500, $42,500 and $4,000. Other bids were: For superstructure and substructure, low-grade and high-grade, Boston Bridge Works, Boston, Mass., $37,827, $47,591; New England Structural Co., Boston, Mass., $30,918, $41,790; United Construction Co., Albany, N. Y., $38,385, $55,545.

DES MOINES, IOWA.—Plans are being prepared to move the present Locust street bridge to the foot of Southeast Sixth street, and build a new one in its place. A scheme to widen the Des Moines River 75 ft. is also being considered, which would necessitate the lengthening of all the wagon and railroad bridges.

ELYRIA, OHIO.—The ordinance providing for a double arch stone bridge at Washington avenue, to cost $25,000, has been passed by the Council.

GILBERTSVILLE, KY.—The Illinois Central R. R. is not ready to ask bids for the new bridge over the Tennessee River at this place.

GOSHEN, IND.—The county may soon ask for bids for bridges and arches.

GRAND RAPIDS, MICH.—The City Council is considering plans for a viaduct at Bartlett street.

GREENCASTLE, IND.—Bids are wanted Aug. 17, by the County Commissioners, reports state, for building superstructures for three bridges.

HAVERHILL, MASS.—The city is considering the building of a bridge in the neighborhood of River and Washington streets, at a cost of about $150,000.

IRONTON, OHIO.—The Ashland & Kentucky Bridge Co. has been organized in this State by consolidation of the Ashland & Iron Bridge Company and the Ironton & Kentucky Bridge Company, with a capital stock of $1,200,000, to build a railroad bridge over the Ohio River between this place and Ashland, Ky.

KANSAS CITY, KAN.—Bids are wanted Aug. 31, by F. M. Holcomb, County Clerk, for a bridge at Twelfth street. Johnson, Wyandotte and Leavenworth Counties will share the cost of rebuilding bridges over the Kaw River at Bonner Springs, Linwood and De Soto.

MCKEESPORT, PA.—Contract for the steel work of the bridge to be built by the Pittsburg, McKeesport & Connellsville over White Hollow at Versailles avenue has been let to the York Bridge Co. for $13,500.

MADISON, GA.—Madison County Commissioners are preparing plans to build two steel highway bridges. Address Q. Williford.

MILWAUKEE, WIS.—According to reports, the contract for building the West Water street bridge has been let to F. W. Moore for $127,000.

NEWARK, N. J.—A contract has been awarded to H. B. Pitcher, of Freehold, at $10,490, to repair and rebuild bridges washed away in Upper Freehold township by recent freshets.

NEW YORK, N. Y.—Bids are wanted Sept. 10 by the Department of Bridges, for the plant, material and the building of the steel superstructure of Blackwell's Island bridge No. 4, over the East River, between the Boroughs of Manhattan and Queens, as advertised in the *Railroad Gazette*. The entire work must be completed on or before Jan. 1, 1906, and $1,000,000 is required as security.

Bids are wanted Aug. 24 for material, the construction of a plant and for the concreting in the anchor chain tunnels, and granite masonry in the cable openings, etc., of the Manhattan and Brooklyn anchorages of the Williamsburg bridge over the East River, as advertised in the *Railroad Gazette*. Gustav Lindenthal, Commissioner of Bridges.

OAKDALE, CAL.—A contract has been awarded to the Pacific Construction Company to build a steel bridge of two 120-ft. spans and 385 ft. of steel trestle, with steel floor beams and concrete abutments, at this place, to cost about $17,850.

SHARON, PA.—The project of a viaduct from South Main street, over the tracks of the Pennsylvania, at a cost of about $75,000, has been favorably reported by the County Commissioners.

A viaduct 450 ft. long, to cost about $43,000, is to be built by the East End Trolley Company, and the bridge portion of the same structure of two spans, 112 ft. each, is to cost about $25,000, to be built by the county. It will extend from the foot of South Main street to Dock street, and have a 22-ft. roadway.

SHELBYVILLE, IND.—A contract, reports state, has been given to Wm. Avery, of Waldron, to build 16 stone bridges for the Indianapolis & Cincinnati Interurban.

SIOUX CITY, IOWA.—Plans have been prepared for a steel bridge to be built by the Chicago & North Western over the new proposed channel of the Floyd River, at a cost of about $57,000.

TERRE HAUTE, IND.—Bids are wanted Sept. 8, it is reported, for over $271,000 worth of bonds, the proceeds of which are to be used for building a wagon and trolley car bridge over the Wabash River between Harrison and Sugar Creek townships. Address Frank E. Benjamin, County Auditor.

TOPEKA, KAN.—The question of adding one or more spans to the Melan bridge at this place is being considered. The work will cost about $60,000. Address City Engineer.

VANCOUVER, B. C.—A contract has been let to the Ironsides, Rannie & Campbell Company for building a trestle and bridge over False Creek for the Great Northern, to cost between $35,000 and $40,000.

WARRENSBURG, MO.—Bids are wanted Aug. 31, by W. H. Burford, for steel bridges in Johnson County, to cost about $15,000.

WESTFIELD, N. Y.—The city may contribute $12,000, and the Lake Erie Traction Company $10,000 for a new bridge, or the traction company may build independently a bridge to cost about $10,000.

WHEELING, W. VA.—Improvements on the Wheeling & Elm Grove Ry. will include the building of a new bridge over Woods Run.

WORCESTER, MASS.—It is reported that the New York, New Haven & Hartford will build a steel truss bridge 80 ft. long, to carry five tracks, at Hermon street.

YOUNGSTOWN, OHIO.—It is reported that the East End bridge will be repaired at a cost of about $53,000. E. M. Schofield, Engineer.

Other Structures.

CEDAR FALLS, IOWA.—The Illinois Central R. R. is not ready to ask bids for the new station at this place, estimated to cost $30,000.

CLARKSDALE, MISS.—A new passenger station, it is stated, will be built at this place by the Yazoo & Mississippi Valley R. R. Co.

CLEBURNE, TEXAS.—Plans have been completed, it is reported, for a station at this place, to be built by the Trinity & Brazos Valley.

ENGLEWOOD, ILL.—A new station for the Chicago & Western Indiana, it is reported, will be built at this place in the spring, to cost about $100,000.

LONSDALE, TENN.—Reports state the Southern will build an addition to the machine shop, or a new building to be 175 ft. x 125 ft., and 10 ft. higher than the old shop.

LOUISVILLE, KY.—A large tract of land, it is reported, has been bought by the Illinois Central near this place for new shops.

NEW YORK, N. Y.—The Rapid Transit Subway Commissioners, it is stated, have bought an additional lot 108 ft. x 200 ft., on which to build an addition to the power house now building on the space between 58th and 59th streets and 11th avenue to the Hudson River. With this addition the plot will be 700 ft. long and 200 ft. wide. The total cost will be about $7,000,000, and it is to be completed about Jan. 1, and be capable of generating 132,000 h.p.

Plans have been filed with the Building Bureau for a two-story freight warehouse of brick and metal, 400 ft. long and 46 ft. wide, to be built in the freight yard of the Erie at the northwest corner of 11th avenue and 28th street, at an estimated cost of

$135,000. The plans provide for a four-story extension in the future.

Oklahoma City, Okla. T.—It is stated that the Missouri, Kansas & Texas will build a brick and stone passenger station, to cost about $35,000, at this place.

Painesville, Ohio.—The Cleveland, Painesville & Ashtabula will build at this place a machine shop and other buildings.

Pittsburg, Pa.—Bids are being asked, reports state, for a 10-stall brick and steel roundhouse and passenger station on the Brownsville extension of the Lake Erie.

Pueblo, Colo.—It is reported that the union station sheds will be built to extend 150 ft. in each direction, at a cost of about $60,000.

Riviere Du Loup, Que.—Bids are wanted Aug. 20, by the Intercolonial Ry., for an engine house at this place.

St. Paul, Minn.—It is reported the Canadian Pacific has awarded a contract to Thomas Kelley for one of the largest roundhouses in Canada, to cost about $250,000.

Sioux Falls, S. Dak.—It is stated the Great Northern will build a new passenger station at this place to cost about $50,000, and a new freight house, and improve its yards, the whole improvements to cost about $100,000.

Whatcom, Wash.—Plans have been completed for a new station and freight shed at this place; to be built by the Great Northern at a cost of $20,000 and $10,000 respectively.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Athens, Amesville & Chauncy.—Incorporation has been granted this company in Ohio to build from Athens, northeast along the Hocking River to the mouth of Sugar Creek, and thence to Amesville, 15 miles, with a branch line north to Millfield, 10 miles. H. H. McKeehan, G. W. Cottrell, R. H. Crowell and others are interested. The principal office of the company will be at Columbus.

Atlanta, Knoxville & Northern.—An officer writes that the report that this company is building a branch line from Knoxville up the Tennessee River to Ross is incorrect. A short spur is projected north from Knoxville to reach several industries which are located on the south side of the Tennessee River. (July 31, p. 562.)

Battenkill (Electric).—Press reports state that this road is nearly completed and will be opened for traffic about Sept. 1. The road runs between Greenwich, N. Y., and Schuylerville, 10 miles, and connects with the Boston & Maine at Schuylerville. I. C. Blandy, Greenwich, is interested. (March 27, p. 239.)

Canadian Northern.—Contracts are reported let to Foley Bros., of St. Paul, for building a branch from the main line at Warroad via Mahung through to Badger, about 35 miles.

Cheyenne & Washita Valley.—An officer writes that the proposed route of this road is from Canadian, Texas, to Chickasha, Ind. T., 180 miles. Surveys have been finished between Cheyenne, Okla. T., and Clinton, 45 miles, and contracts for grading this section will shortly be let. J. B. Harrison is President; H. D. Cox, Vice-President, and J. P. Johnson, Secretary, all of Cheyenne, Okla. T. (July 31, p. 562.)

Chicago, Rock Island & Pacific.—This road will build an extension from Winterset to Greenfield, seven miles. The entire line is surveyed and rights of way have been secured.

Columbia & Port Deposit.—This road, which runs between Columbia, Pa., and Perryville, Md., 43 miles, and which has been closed since June 9, will shortly be reopened for traffic. Construction crews are now at work clearing the tracks.

Columbus & Lake Michigan.—It is reported that the reorganization of this company has been practically completed and that work will shortly be begun on the extension from Lima southeast to Columbus, Ohio, 70 miles. C. T. Hobart, Lima, Ohio, is Chief Engineer. (April 24, p. 304.)

Council Bluffs, Tabor & Southern (Electric).—Articles of incorporation have been filed by this company in Iowa. It is proposed to build and operate an electric line from Council Bluffs, Pottawattamie County, through Mills and Fremont Counties in Iowa, and Nodaway, Holt, Andrews and Buchanan Counties in Missouri, to a terminus not yet determined. The surveys for part of the line have been made and some of the rights of way have been secured. It is reported that contracts for grading will be let in the fall. W. J. Dobbs is President; W. H. Rhodes, Vice-President, and Ezra D. Arnold, Electrical Engineer, all of Council Bluffs, Iowa.

Detroit & Mackinac.—The following extensions are now being built by this company in Michigan: Omer to Au Gres, eight miles; Tower to Cheboygan, 22 miles; Onaway to Black Lake, 5½ miles. M. J. Griffin, Detroit, Mich., is in charge of the work.

Fish River.—This company, which was recently leased to the Bangor & Aroostook, proposes to build a branch line from Squa Pan, in the north part of Masardis County, through Ashland, Castle Hill, Mapleton, Washburn, Wade and Perham to the St. John River at Frenchville, about 80 miles.

Fort Wayne-Decatur.—Contract for grading this electric line between these two points will be let within the next 16 days. Bids will be received until Aug. 15, at Decatur, Ind. W. H. Fledderjohn, New Knoxville, is General Manager.

Gulf, West Texas & Pacific.—Surveys are in progress for an extension of this line from Placedo, Texas, to Hines Bay, 25 miles. It is stated that contracts for grading will be let about Sept. 1. The road runs at present between Victoria and Beeville, 56 miles.

Heimbach R. R.—A charter has been granted this company, with power to build a steam railroad from Walnutport, Northampton County, Pa., in an easterly direction to Alliance, 14 miles. J. S. Moyer, Bethlehem, Pa., is President.

Illinois Central.—A contract has been awarded to J. J. Baxter, Memphis, Tenn., for grading three miles of road from Grenada, Tenn., to creosote works. Work will be begun at once.

Ithaca & Auburn Electric.—An officer writes that contracts will be let about August 24 for building this line from Ithaca, N. Y., to Auburn, 37 miles. The road has been financed and the work will include two steel bridges. Sherman Collins, Ithaca, N. Y., is President. (See Construction Supplement.)

Kansas Central, Oklahoma & Gulf.—A territorial charter has been granted this company in Oklahoma. It is proposed to build from Enid, Okla. T., to New Orleans and Galveston. J. A. Koontz, Hutchinson, Kan.; D. D. Thomas and F. C. Spaulding, Kansas City, are incorporators.

Lewiston & Owyhee.—Incorporation has been granted this company in Washington to build a railroad from Huntington, Ore., through the Counties of Baker, Union, Wallowa and Nez Perce to Lewiston, Idaho, 200 miles. M. O. Reed, Colfax, Wash., is President; J. F. Hale, Battle Creek, Neb., Vice-President, and G. B. Baker, Dayton, Wash., Secretary.

Lindsay, Bobcaygeon & Pontypool.—Contract is reported let to E. F. Fouquier, of Ottawa, for building this line from Pontypool north to Lindsay, and thence northeast to Bobcaygeon, 40 miles. The new line, when completed, will form a link in the short line which is now being built by the Toronto, Lindsay & Pembroke between Toronto and Ottawa. H. W. Armstrong, Lindsay, Ont., is reported in charge of the work. (May 8, p. 336.)

McKinney, Decatur & Western.—An officer writes that the proposed route of this road is from McKinney, Texas, to Decatur and Bridgeport, 70 miles, and also from McKinney east to Mansfield, La., 180 miles. Surveys are now in progress and contracts will shortly be let. M. J. Healey is Vice-President and General Superintendent, and J. A. Merryweather is Chief Engineer.

McMinnville, Woodbury & Nashville (Electric).—A charter has been granted this company in Tennessee, with power to build an electric line between the above named points, a distance of 60 miles. Thomas S. Weaver, W. S. Henderson and others, of Nashville, Tenn., are reported interested.

Manistee & Northeastern.—An officer writes that grading is now in progress on the extension from Kaleva, Mich., in a northeasterly direction through the northwestern portion of Wexford County. (July 31, p. 562.)

Mobile, Jackson & Kansas City.—It is reported that this road will be extended from Beaumont, Miss., to Jackson, Tenn., 332 miles, passing through Laurel, Newton, Louisville, Ackerman, Houston, Pontotec, New Albany, Ripley and Middleton. This extension includes the Gulf & Chicago, which has recently been leased by the Mobile, Jackson & Kansas City. The line has been surveyed from Beaumont to Ackerman, 172 miles. C. D. Smith & Co., Memphis, Tenn., have received the contract for grading the section between Newton, Miss., and Pontotec, 150 miles. (Aug. 7, p. 580.)

New Mexican Roads.—Preliminary surveys are being made by the Teho-Stegner Company of Missouri for a railroad entering New Mexico from the east, in Guadaloupe County, and leaving on the west through Socorro County into Arizona, the western terminal to be on the southern California coast.

New York Central & Hudson River.—For new terminal plans see Technical.

Northampton Central.—A charter has been granted this company in Pennsylvania to build a steam railroad 12 miles long in Northampton County, between Bath and Nazareth. J. S. Moyer, Bethlehem, Pa., is President, and H. F. Weaver, South Bethlehem, Pa., and Geo. H. Kressler, West Bethlehem, Pa., are directors.

North State R. R.—This company has been incorporated in North Carolina to build a line from Johnston's Mill to a point in Harnett County, 10 miles. Connection will be made with the Raleigh & Cape Fear at Johnston's Mill. J. L. Brown, C. I. Williams, C. H. Kaylor, K. B. Johnston and others, of Cardenas, N. C., are incorporators.

Ohio Eastern.—This company has been incorporated in Ohio, with principal offices at Lisbon. The northern terminus of the road will be Lisbon, and it will extend in a southeasterly direction to a point on the Little Beaver Creek where it crosses the Pennsylvania line. E. W. Brink, J. V. Morris, L. B. Foote and others, of Lisbon, Ohio, are interested.

Orange & Northwestern.—Press reports state an extension will shortly be built by this company from Bunker Hill, Texas, to Logansport, La., 130 miles, passing through Henton, Sabine and Shelby Counties, all in Texas. H. L. Montanden, Orange, Texas, is in charge of the work. (See Construction Supplement.)

Potomac & Pocahontas.—An officer writes that grading will be begun at once on this proposed road from Keyser to Maysville, W. Va., 30 miles. J. B. Caldwell, Brookville, Pa., is Chief Engineer. (See Construction Supplement.)

Reading, Lancaster & Southern.—This company has filed a mortgage for $2,300,000 to build a railroad between Baltimore and Reading. Such a line would shorten the distance between these points 50 miles. Rights of way have been obtained for two-thirds of the distance from Mohnsville to Adamstown, six miles. Isaac Spatz, of Mohnsville, is President, and Sydney C. Long, of Baltimore, Secretary.

Southern.—The newspapers say that a contract has been awarded to W. J. Oliver & Co., Knoxville, Tenn., for building an extension from LaFollette through the narrows to Jellico, 28 miles. It is reported that the new line will give the road a less than 1 per cent. grade, in place of the present 2½ per cent. grade.

Southern Central.—This company has been incorporated in Canada with power to build from Vancouver east via Kootenay Pass, Crow's Nest Pass, Old Man River and Saskatchewan to a point on Hudson Bay, 100 miles north of Fort Churchill. J. D. McLennan, of Cleveland; E. F. B. Johnson, of Toronto, and James Whalen, of Port Arthur, are interested.

Southern Pacific.—An officer writes that the Santa Susana tunnel is now practically completed. This tunnel is 7,369 ft. long and is built in the Simi Pass, through the Santa Susana mountains, between Montalvo and Chatsworth, on the Chatsworth Park cut-off of the Southern Pacific between San Francisco and Los Angeles. Boring was begun in July, 1900, by Erickson & Peterson, the contractors. On July 23 of the present year, only 172 ft. of bench remained to be removed, and the indications point to the completion of the tunnel by the first of September. The tunnel passes through various strata of rock but principally through soft sandstone. It was built to reduce the time, distance, grades and curvature between San Francisco and Los Angeles.

South Georgia & West Coast.—Contract is reported let to Lester Bros. for grading the remainder of this line from Greenville south to Deadman's Bay, Fla. The road runs at present between Heartpine, Ga., and Greenville, Fla., 51 miles. J. W. Oglesby, Quitman, Ga., is President. (See Construction Supplement.)

Union Pacific.—Surveys are reported in progress for a spur line from Thayer, Wyo., to coal mines north of Rock Springs, 22 miles.

Varner, Cummings & Eastern.—Press reports state that work will be begun on this road at once. The proposed route is from Linwood, Ark., to Watson, 50 miles. Surveys have been finished and rights of way secured. J. A. Franklin, Little Rock, Ark., is President. (July 31, p. 562.)

Western Pacific.—It is reported that a branch line will be built by this company from Haywards, Cal., via San Jose, to San Francisco, 74 miles, before proceeding with the main line from Oakland to Salt Lake City.

West Virginia Central & Pittsburg.—The extension of this road from Elkins, W. Va., to Durbin, 47 miles, has been completed and the line will shortly be placed in operation. The new line parallels the Chesapeake & Ohio for the greater part of the distance between these two points, and will open up a rich coal and lumber region.

GENERAL RAILROAD NEWS.

Altoona & Beech Creek.—The rights and franchises of this company will be sold at auction on Aug. 14, 1903, at Hollidaysburg, Pa. The road runs from Altoona, Pa., via Kipple to Falling Timber, 18 miles, and connects with the Beech Creek Division of the New York Central. It is reported that the New York Central will probably purchase the road.

Atlantic Coast Line.—Press reports state that this company, together with the Southern Railway, is jointly interested in a new terminal organization which has recently been incorporated at Charleston. The new company has acquired the property of the East Shore Terminal and of the Commercial Wharf & Cotton Press Company, which was purchased jointly at foreclosure sale by the Atlantic Coast Line and the Southern Ry. A mortgage has been executed with the Standard Trust Co., of New York, to secure $1,000,000 of 4 per cent. 50-year gold bonds.

Canadian Pacific.—At a meeting of the directors of this company on August 10, a semi-annual dividend of 3 per cent. was declared on the common stock, which is an increase of 1 per cent. annually. The regular dividend of 2 per cent. was also declared on the preferred stock. Gross earnings for the fiscal year ending June 30 were $43,957,273, and operating expenses $28,120,527, leaving net earnings of $15,836,845.

Chicago, Rock Island & Pacific.—The *Commercial and Financial Chronicle* states that the probable purposes for which the new bonds will be issued by this company are as follows: New roads built and unbonded, 800 miles, $16,000,000; St. Louis-Kansas City line now building, with second track, bridges, stations, etc., $10,000,000; one-half of the cost of the Rock Island-Lake Shore station in Chicago, $1,800,000; shops building at Moline, Ill., $1,500,000; refunding of $18,000,000 St. Louis & San Francisco collateral 5 per cent. bonds, subject to call at 102, $18,360,000. The limit of the authorized issue is placed at $250,000,000.

Coahuila & Pacific.—L. D. Ross, of New York, and J. W. Hardenburg, Jersey City, have been appointed receivers for this company, which operates a railroad between Terreon and Saltillo, Mexico. The bill asking for the appointment of the receivers was filed by J. J. Detwiler, Jersey City, on the ground that as the road is without funds for further operation, and has $319,000 liabilities, there is danger of the property being seized by the Mexican Government because of failure to carry out its mail contracts with the Government.

Colorado & Northwestern.—This road, which runs between Boulder, Colo., and Ward, 26 miles, will be sold under foreclosure within the next 90 days. The Mercantile Trust Company of New York is the mortgage trustee.

Knoxville & Ohio.—This company, which is leased by the Southern Railway, has obtained control of the stock of the Knoxville & Bristol and the Tennessee Northern Railroads, both of which are owned by the La Follette Coal, Iron & Railway Co. The Knoxville & Bristol is 40 miles long and runs between Morristown and Corryton, Tenn. The Tennessee Northern is 10 miles long and runs between La Follette and La Follette Junction. It is reported that an issue of $3,000,000 of bonds will be made by the Knoxville & Ohio in order to pay for the acquisition of these two roads and for necessary improvements on them.

Moncton & Victoria Beach.—This road has been sold to Mackenzie & Mann and will be operated as a part of their Halifax & Southwestern system. The line runs from Middleton, where it connects with the Dominion Atlantic Railway, to Victoria Beach, 41 miles.

Northern Securities Company.—Judge Lochren, of the United States Circuit Court at St. Paul, recently decided in favor of the defendants in a suit which was brought against the Northern Securities Company by the State of Minnesota. According to the decision, the consolidation of the Great Northern R. R. Co. and the Northern Pacific R. R. Co. into the Northern Securities Company is in no way a violation of the anti-trust act of the State of Minnesota. The State of Minnesota will appeal the case. The two other cases which are pending against the Northern Securities Company will not be tried until the fall.

St. Louis Southwestern Railway of Texas.—This company has authorized an issue of bonds not to exceed $25,000 per mile, with interest at 5 per cent., to mature in 30 years. These bonds will cover the Texas & Louisiana R. R. recently purchased, and an extension from Lufkin to Newton, Jasper County, Texas, 70 miles.

Seaboard Air Line.—The gross earnings for this company for the fiscal year ending June 30, 1903, were $12,156,928, an increase of $1,088,449 over the same period in 1902. Operating expenses were $9,318,778, an increase of $1,174,558, leaving a decrease in net earnings of $47,846.

Union Pacific.—According to preliminary statements, the gross earnings of this company for the fiscal year ending June 30, 1903, show an increase of $3,474,906 over the same period in 1902. Operating expenses increased $3,187,989, leaving an increase in net earnings of $286,920.